Nokia Customer Care

Service Manual

RM-91; RM-92 (Nokia N80)

Mobile Terminal

Part No: 9246921 (Issue 1)

COMPANY CONFIDENTIAL

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Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
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Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

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ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

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Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

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While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

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Nokia N80 Service Manual Structure

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1 — General Information

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RM-91/92 product selection

Nokia RM-91/RM-92 is a WCDMA/GSM dual mode handportable phone. RM-91 supports GSM (GSM850, E-GSM900,GSM1800 & GSM1900) and WCDMA1900, RM-92 GSM (GSM850, E-GSM900, GSM1800 & GSM1900) and WCDMA2100.

According to GSM standard 05.05 it responds to class 4 (max. 2W) in EGSM 900, class 1 (1W) in GSM 1800 and class 1 in GSM 1900. RM-91/92 supports EGPRS (EDGE) class B as well as Bluetooth 1.2 standard. The handset has a full phase 2 Type Approval and it complies with the GSM Type Approval. RM-91/92 also has a full CE approval and FCC approval.

RM-91/92 supports two-way video calls with two integrated cameras. It is an MMS (Multimedia Messaging Service) enabled phone with a large bright color display and an integrated 3 megapixel camera with macro mode and a VGA digital camera.

The MMS implementation follows the OMA MMS standard release 1.2.

WAP 2.0 compatible browser supports XHTML Mobile Profile (MP) and uses a TCP/IP stack to communicate with a gateway in network.

RM-91/92 uses Symbian 9.1a operating system and supports also MIDP Java 2.0 & CLDC1.1, providing a good platform for 3rd party applications.

Figure 1 View of RM-91/92

RM-91/92 product features and sales package

Display and user interface

- Active matrix colour display (352x416, up to 262,144 colours)
- Automatic brightness control for display
- 4-way scroll key with center select, two softkeys, application-key, edit and clear key, send & end key, multimedia key
- Dedicated capture key for instant camera activation
- System: EGSM 850/900/1800/1900 + WCDMA 1900/2100 GHz

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- User interface: S60 software on Symbian OS

Imaging and video

- Integrated 3 Megapixel camera with up to 20 x digital zoom and close-up mode
- Landscape capture with dedicated capture key
- Integrated Flash LED with anti-red eye
- High-quality video capture in MP4 and 3GP formats with up to 5x digital zoom
- Image and video editors
- Nokia Lifeblog
- Image and video uploading to the web
- XpressPrint over infrared, Bluetooth wireless technology, PictBridge and UPnP directly from Gallery

Entertainment

- Integrated digital music player with stereo audio. Supported file formats: MP3, AAC, m4a, eAAC+ and wma
- USB mass storage that enables easy drag and drop of files, such as music tracks
- Stereo FM radio with support for Visual Radio
- Multimedia player (RealPlayer) with 3GPP & MPEG4 AVC video streaming support
- Internet browser

Productivity

- Office document viewers (Microsoft Word, PowerPoint, Excel)
- PC Suite connectivity with USB, Bluetooth wireless technology, and IrDa
- WLAN connectivity
- Advanced S60 PIM (calendar, contacts, task list, PIM printing, etc.)
- Voice recording, dialing and voice commands
- Push to talk (PoC) application
- SettingWizard for easy settings configuration
- Video sharing and two-way video call

Messaging

- E-mail with document viewers to view attachments
- SMS, multimedia messaging (MMS)

Memory functions

- Up to 40 MB of internal dynamic memory for images, contacts, text messages, multimedia messages, ringing tones, images, video clips, calendar notes, to-do list and applications. Please note that the preinstalled applications on the user data area of the device memory will reduce the informed amount of available memory, unless uninstalled.
- Expandable memory: 128 MB miniSD card. *
- Hot swap slot for easy memory card insertion and removal

*The memory capacity of the memory card in the sales package may vary depending on the market and/or your network operator/service provider.

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Connectivity

- Integrated Wireless LAN (802.11g) and UPnP (Universal Plug and Play)
- Bluetooth wireless technology
- Infrared
- Pop-Port™ with USB 2.0 Full Speed with mass storage class

Operating frequency and data transfer

- WCDMA1900/2100 and quadband GSM/EDGE (EGSM 850/900/1800/1900) WCDMA1900/2100 with simultaneous voice and packet data (PS max speed UL/DL= 384/384kbps, CS max speed 64kpbs)
- EGPRS (Class A, Multislot class 11) – Max download 236.8 kbps; upload 118.4 kbps
- Data transfer (from compatible S40 phones S60 phones)

Java

- Java™ MIDP 2.0, CLDC 1.1
- Over-the-air download of Java™-based applications and games

Sales package

- Transceiver RM-91/92
- Charger (AC-4)
- Charger adapter (CA-44)
- Battery (BL-5B)
- Stereo headset (HS-23)
- Connectivity cable (CA-53)
- Wrist strap
- 128 MB miniSD memory card*
- Audio adapter (AD-15)

*The memory capacity of the memory card in the sales package may vary depending on the market and/or your network operator/service provider.

Product and module list

Module name	Type code	Notes
System/RF Module	RM-91: 1ME RM-92: 1NN	Main PWB with components
UI Module	1MJ	Keyboard PWB with components. Part of the UI Frame Assy
Front Camera Module		Camera module VGA
Back Camera Module		3MP camera with macro
Display Module		
Engine Shield Assembly		Part of slide assembly
Slide Assembly		Mechanical assembly
Core SW Module		

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Mobile enhancements

Table 1 Audio

Enhancement	Type
Boom mono headset	HDB-4
Fashion stereo headset	HS-3
Mono headset	HS-5
Stereo headset	HDS-3
Retractable headset	HS-10
Loopset	LPS-4
FM radio headset	HS-2R
Wireless headset	H-36W
	HDW-3
	HS-37W
	HS-4W
	HS-11W
Wireless clip-on headset	HS-21W
Music stand	MD-1
Headset adapter	AD-15
TTY adapter	HAD-10

Table 2 Car

Enhancement	Type
Mobile charger	DC-4
Headrest handsfree	BHF-3
Basic handsfree	HF-3
Advanced car kit (sales pack)	CK-7W
Wireless car kit	CK-1W
Wireless plug-in car handsfree	HF-6W
Car kit	CK-10
Car kit	N616
Mobile holder	CR-39

Table 3 Data

Enhancement	Type
Connectivity adapter cable	DKU-2

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Enhancement	Type
Connectivity adapter cable	CA-53
Wireless GPS module	LD-1W
Mini SD memory card	

Table 4 Imaging

Enhancement	Type
Photo flash	PD-2
Image album	PD-1

Table 5 Messaging

Enhancement	Type
Nokia digital pen	SU-1B
Bluetooth QWERTY keypad	SU-8W

Table 6 Power

Enhancement	Type
Battery 820mAh Li-ion	BL-5B
Travel charger	AC-3
	AC-4
Charger adapter	CA-44

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm3)
Transceiver with BL-5B 820mAh li-ion battery back	95.4 x 50 x 23.4 (26mm at camera)	~ 134	97.4

Main RF characteristics for GSM850/900/1800/1900 and WCDMA1900/2100 phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA1900 or WCDMA2100

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Parameter	Unit
Rx frequency band	GSM850: 869 - 894MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA1900: 1930-1990MHz
	WCDMA2100: 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA1900: 1850-1910MHz
	WCDMA2100: 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA -50 ... 24 dBm
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-5B	820	up to 3 hrs (GSM) up to 2.5 hrs (WCDMA)	up to 8 days

Charging times

AC-3	AC-4
approx. 120min	approx. 70 min

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2 — Parts Lists and Component Layouts

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Exploded view

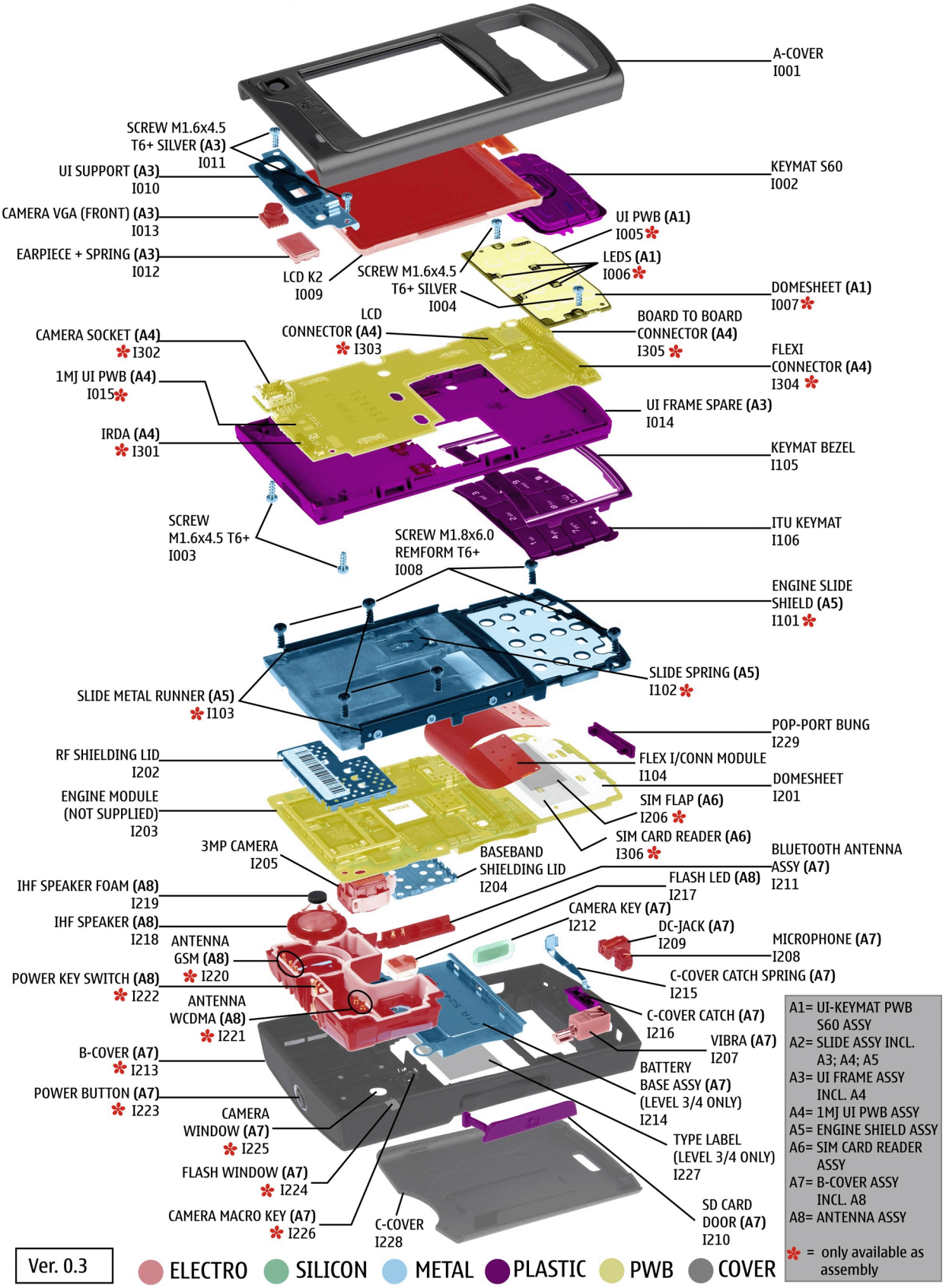

Figure 2 RM-91/92 exploded view

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Spare parts overview

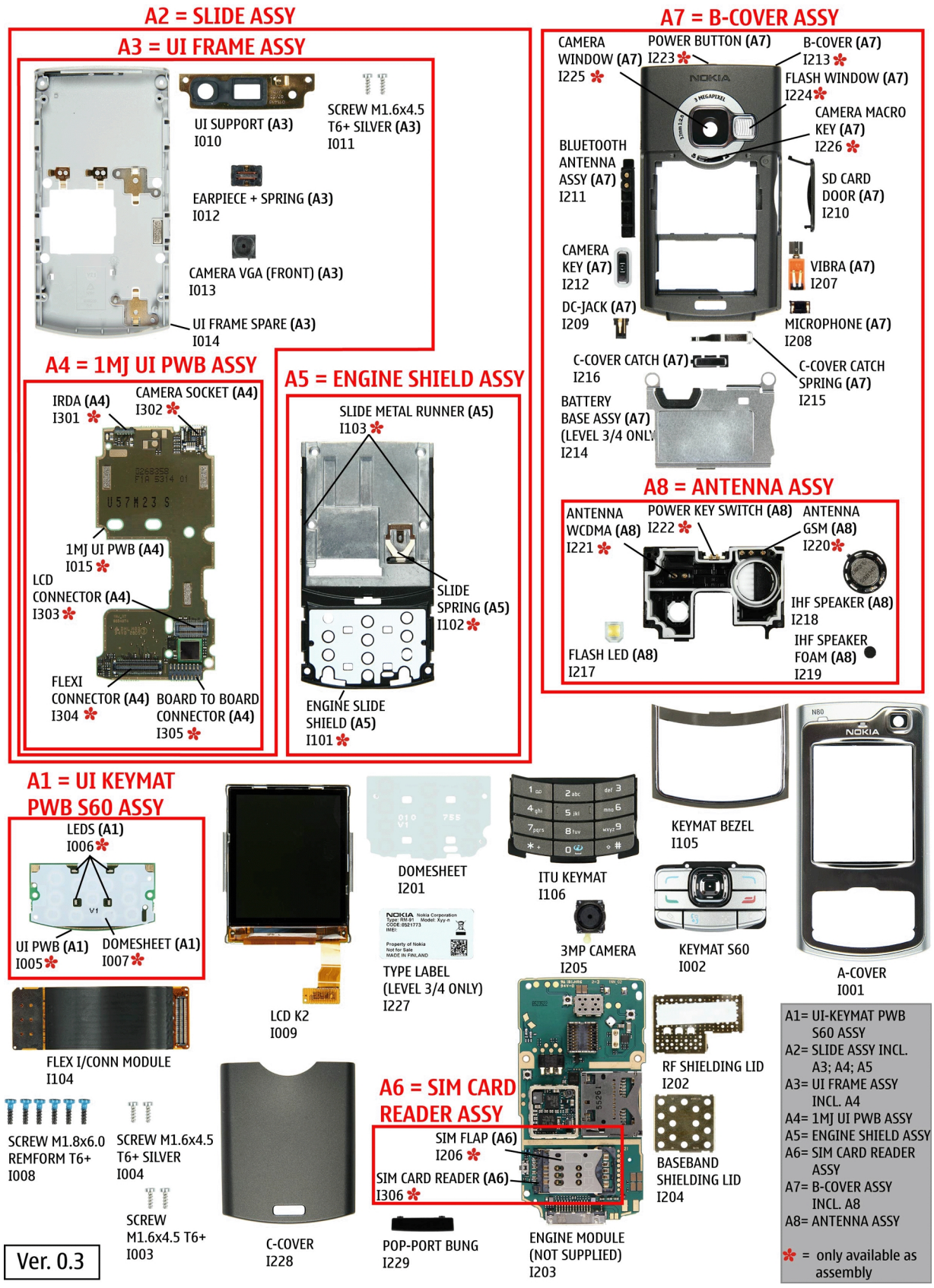

Figure 3 RM-91/92 spare parts overview

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Mechanical spare parts list

ITEM/CIRCUIT REF.	QTY	PART NAME
I001	1	A-COVER
I002	1	KEYMAT S60
I003	2	SCREWS M1.6 X 4.5 T6+
I004	2	SCREWS M1.6 X 4.5 T6+ SILVER
A1	1	UI-KEYMAT PWB S60 ASSY (I005 -I007)
I005	1	UI PWB
I006	4	LEDS
I007	1	DOMESHEET
I008	6	SCREW M1.8x6.0 REMFORM T6+
I009	1	LCD AM 352x416 COG 256kCO Keyno
A2	1	SLIDE ASSY (A3 + A4 + A5)
A3	1	UI FRAME ASSY (I010 - I013 + A4)
I010	1	UI SUPPORT
I011	2	SCREWS M1.6 X 4.5 T6+ SILVER
I012	1	EARPIECE + SPRING
I013	1	CAMERA VGA (FRONT)
I014	1	UI FRAME SPARE
A4	1	1MJ UI PWB ASSY (I014 & I301 - I305)
I015	1	1MJ UI PWB
I301	1	IRDA
I302	1	CAMERA SOCKET
I303	1	LCD CONNECTOR
I304	1	FLEXI CONNECTOR
I305	1	BOARD TO BOARD CONNECTOR
A5	1	ENGINE SHIELD ASSY (I101 - I103)
I101	1	ENGINE SLIDE SHIELD
I102	1	SLIDE SPRING
I103	2	SLIDE METAL RUNNER
I104	1	FLEX I/CONN MODULE
I105	1	KEYMAT BEZEL
I106	1	ITU KEYMAT

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ITEM/CIRCUIT REF.	QTY	PART NAME
I201	1	DOMESHEET
I202	1	RF SHIELDING LID
I203	1	ENGINE MODULE
I204	1	BASEBAND SHIELDING LID
I205	1	3MP CAMERA
A6	1	SIM CARD READER ASSY (I206 & I306)
I206	1	SIM FLAP
I306	1	SIM CARD READER
A7	1	B-COVER ASSY (I207-I226)
I207	1	VIBRA
I208	1	MICROPHONE
I209	1	DC-JACK
I210	1	SD CARD DOOR
I211	1	BLUETOOTH ANTENNA ASSY
I212	1	CAMERA KEY
I213	1	B-COVER
I214	1	BATTERY BASE ASSY
I215	1	C-COVER CATCH SPRING
I216	1	C-COVER CATCH
A8	1	ANTENNA ASSY (I217-I 222)
I217	1	FLASH LED
I218	1	IHF SPEAKER
I219	1	IHF SPEAKER FOAM
I220	1	ANTENNA GSM
I221	1	ANTENNA WCDMA
I222	1	POWER KEY SWITCH
I223	1	POWER BUTTON
I224	1	FLASH WINDOW
I225	1	CAMERA WINDOW
I226	1	CAMERA MACRO KEY
I227	1	TYPE LABEL
I228	1	C-COVER

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

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RM-91 component parts lists and layouts

Component parts list 1ME_09a

Item	Side	Grid ref.		Type	Description and value		
A4000	Top	E	10	MIRO_BT_SHIELD_9590738	SHIELD R1113 BLUETOOTH	~	~
A7000	Top	F	16	MIRO_RF_SHIELD_0264194	SHIELD R1113 RF ASSY	~	~
A7003	Bottom	E	16	MIRO_PWR_SHIELD_9590739	SHIELD R1113 POWER SUPPLY	~	~
A7005	Bottom	H	8	MIRO_BB_SHIELD_0264195	SHIELD R1113 BB ASSY	~	~
B2200	Bottom	G	8	CRYSTAL_3.3X1.6_H0.9	CRYSTAL 32.768KHZ +-20PPM 12.5PF	32.768kHz	~
C1100	Bottom	I	14	0402C	Chipcap 5% NP0	10p	50V
C1101	Bottom	I	13	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C1103	Bottom	G	14	0402C	Chipcap 5% NP0	10p	50V
C1104	Bottom	H	13	0402C	Chipcap 5% NP0	10p	50V
C1105	Bottom	H	11	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C1109	Bottom	H	11	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2005	Bottom	F	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2006	Bottom	F	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2007	Bottom	H	2	0402C	Chipcap 5% NP0	10p	50V
C2008	Bottom	H	2	0402C	Chipcap 5% NP0	10p	50V
C2009	Bottom	H	2	0402C	Chipcap 5% NP0	10p	50V
C2010	Bottom	H	2	0402C	Chipcap 5% NP0	10p	50V
C2012	Bottom	C	2	0603C_H0.95	CHIPCAP X5R 1U K 25V 0603	1u0	25V
C2106	Bottom	I	7	0402C	Chipcap 5% NP0	56p	50V
C2107	Bottom	I	7	0402C	Chipcap 5% NP0	56p	50V
C2108	Bottom	H	7	0402C	Chipcap 5% NP0	15p	50V
C2109	Bottom	H	7	0402C	Chipcap 5% NP0	15p	50V
C2110	Bottom	J	14	0402C	Chipcap 5% NP0	56p	50V

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Item	Side	Grid ref.		Type	Description and value		
C2111	Bottom	I	13	0402C	Chipcap 5% NP0	56p	50V
C2113	Bottom	I	14	0402C	Chipcap 5% NP0	56p	50V
C2114	Bottom	I	14	0402C	Chipcap 5% NP0	56p	50V
C2115	Bottom	I	14	0402C	Chipcap 5% NP0	56p	50V
C2202	Bottom	G	7	0402C	Chipcap X5R 10% 6.3V 0402	220n	6.3V
C2203	Bottom	I	8	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C2204	Bottom	I	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C2205	Bottom	G	7	0402C	Chipcap X5R 10% 6.3V 0402	220n	6.3V
C2206	Bottom	G	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2211	Bottom	I	8	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C2213	Bottom	G	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2215	Bottom	H	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2217	Bottom	H	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2220	Bottom	I	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2222	Bottom	H	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2226	Bottom	G	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2228	Bottom	H	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2301	Bottom	F	9	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2302	Bottom	I	9	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2304	Bottom	H	10	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V

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Item	Side	Grid ref.		Type	Description and value		
C2312	Bottom	G	8	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C2314	Bottom	G	10	0805C	CHIPCAP X5R 4U7 M 25V 0805	4u7	25V
C2316	Bottom	G	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2317	Bottom	G	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2320	Bottom	H	10	0603C	CHIPCAP X5R 10UF 6V3 0603	10u	4V
C2700	Bottom	I	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2800	Top	I	14	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2801	Top	F	15	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2802	Top	G	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2803	Top	F	14	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2804	Top	I	13	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2805	Top	F	14	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2806	Top	F	15	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2807	Top	I	14	0402C	Chipcap 5% NP0	12p	50V
C2809	Top	I	12	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C3502	Bottom	G	10	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C3503	Bottom	G	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C4000	Top	F	10	0402C	Chipcap 5% NP0	15p	50V
C4001	Top	F	10	0402C	Chipcap 5% NP0	100p	50V
C4002	Top	F	10	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C4003	Top	F	10	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V

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Item	Side	Grid ref.		Type	Description and value		
C4004	Top	D	10	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C4005	Top	E	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4006	Top	D	10	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4007	Top	D	10	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4008	Top	E	9	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4009	Top	E	9	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4010	Top	D	9	0402C	CHIPCAP X5R 0U47 K 6.3V 0402	0u47	6V3
C4011	Top	F	10	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C4012	Top	F	10	0402C	CHIPCAP X5R 0U47 K 6.3V 0402	0u47	6V3
C4200	Top	I	10	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4201	Top	J	11	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4202	Top	E	11	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4203	Top	D	11	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4204	Bottom	I	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4205	Top	G	12	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4402	Top	E	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4403	Top	D	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4404	Top	C	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4405	Top	E	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4407	Top	B	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V

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Item	Side	Grid ref.		Type	Description and value		
C4408	Top	E	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4409	Top	B	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4410	Top	B	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4415	Bottom	D	17	0402C	Chipcap 5% NP0	10p	50V
C4419	Top	B	9	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C4420	Top	D	7	0402C	Chipcap 5% NP0	15p	50V
C4428	Top	E	9	0402C	Chipcap 5% NP0	15p	50V
C4429	Top	D	9	0402C	Chipcap 5% NP0	15p	50V
C4435	Top	C	7	0402C	Chipcap 5% NP0	15p	50V
C4800	Top	H	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4801	Top	J	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4803	Top	I	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4808	Top	I	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5002	Top	H	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5500	Top	G	9	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C5501	Top	G	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C5504	Top	G	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C5505	Bottom	F	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C5506	Bottom	F	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C5508	Top	H	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5509	Top	H	7	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C5511	Top	H	7	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V

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Item	Side	Grid ref.		Type	Description and value		
C6100	Top	I	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6101	Top	J	8	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6102	Top	J	8	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6103	Top	I	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6104	Top	I	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6105	Top	I	7	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6106	Bottom	G	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6107	Bottom	G	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6108	Top	I	7	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6109	Bottom	J	5	0402C	Chipcap 5% NP0	47p	50V
C6110	Bottom	I	5	0402C	Chipcap 5% NP0	27p	50V
C6112	Top	I	8	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6113	Top	I	8	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6500	Bottom	B	14	1206C_H1.8	CHIPCAP 2U2 K 25V 1206	2u2	25V
C6502	Bottom	C	14	0805C	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3
C6503	Bottom	B	14	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6505	Bottom	F	16	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6506	Bottom	F	16	0402C	Chipcap X5R 10% 6.3V 0402	220n	6.3V
C6507	Bottom	E	16	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6508	Top	C	13	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6509	Top	C	13	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V

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Item	Side	Grid ref.		Type	Description and value		
C6510	Top	C	13	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6511	Top	B	13	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6512	Top	B	13	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6513	Top	B	9	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6514	Top	B	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6515	Top	D	9	0805C	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3
C6516	Top	C	9	0805C	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3
C6520	Top	B	13	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6523	Bottom	F	16	0402C	Chipcap 5% NP0	15p	50V
C6524	Bottom	E	16	0402C	Chipcap 5% NP0	15p	50V
C7501	Top	D	17	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7503	Top	D	15	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7504	Top	F	17	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7505	Top	D	16	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C7506	Top	D	16	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7507	Top	C	15	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7508	Top	D	16	0402C	Chipcap 5% NP0	18p	50V
C7509	Top	D	16	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7511	Top	D	17	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7513	Top	C	16	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7515	Top	C	17	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7516	Top	C	17	0402C	CHIPCAP NP0 470P J 6V3 0402	470p	6V3

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Item	Side	Grid ref.		Type	Description and value		
C7518	Top	F	14	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C7520	Top	G	17	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7522	Top	G	15	0402C	Chipcap 5% NP0	15p	50V
C7523	Top	G	17	0402C_AVX	CHIPCAP NP0 HQ 3P9 J 16V 0402	3p9	16V
C7524	Top	G	15	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7525	Top	H	15	0402C	Chipcap 5% NP0	18p	50V
C7541	Top	E	14	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7542	Top	E	14	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7543	Top	D	14	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7544	Top	F	14	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C7545	Top	C	14	0402C	Chipcap 5% NP0	10p	50V
C7547	Top	C	14	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7548	Top	F	14	0402C	Chipcap 5% NP0	18p	50V
C7580	Top	E	17	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7581	Top	E	17	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7582	Top	E	17	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7583	Top	E	17	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7584	Top	E	15	0402C	Chipcap 5% NP0	15p	50V
C7585	Top	E	15	0402C	Chipcap 5% NP0	15p	50V
C7586	Top	E	15	0402C	Chipcap 5% NP0	10p	50V
C7587	Bottom	E	15	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7588	Bottom	D	16	0402C	Chipcap 5% NP0	100p	50V
C7589	Top	B	14	0402C	CHIPCAP NP0 1P2 B 50V 0402	1p2	50V
C7590	Bottom	E	16	0402C	Chipcap 5% NP0	10p	50V

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Item	Side	Grid ref.		Type	Description and value		
C7645	Top	D	16	0402C	Chipcap X7R 10% 16V 0402	10n	16V
D2800	Top	H	14	VFBGA343	RAP3GS V2.0E-PA VFBGA	~	~
D2801	Top	H	14	FBGA128_EMPTY	COMBO 128M NOR +128M DDR DRAM FBGA128	8Mx16/8Mx16	~
D5000	Top	E	12	FBGA133_11.6X13.1	COMBO 512 DDR + 1G NAND FBGA133 PBFREE	32Mx16/128Mx8	~
D5500	Top	H	7	PDSO_G5	OR-GATE 2INPUT 74LVC1G32 SC70-5	~	~
D6500	Top	C	12	FBGA_195	OMAP DM290 GOLDENEYE NFBGA	~	~
D6501	Top	C	11	WBGA_60_8.1X6.6	SDRAM 4X16 1.8V/1.8V FBGA60 PBFREE	4Mx16	~
F2000	Bottom	D	2	0603_FUSE_AVX2MATS	SM FUSE F 2.0A 32V	2A	~
G2200	Top	I	15	BATTER_EECEP	RTC BACUP CAPAC 311 SIZE FOR 2.6V 4UAH	2.6V	~
G7500	Top	C	17	VCO_DCS02733	VCO 3296-3980MHZ 4-BAND MATSUSHITA	3296-3980 MHz	~
G7501	Top	C	16	NKG3176B_H1.0	VCTCXO 38.4MHZ 2.5V 2MA	38.4MHz	~
L2000	Bottom	D	2	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~
L2002	Bottom	E	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
L2003	Bottom	E	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
L2004	Bottom	F	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
L2005	Bottom	F	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~

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Item	Side	Grid ref.		Type	Description and value		
L2006	Bottom	G	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2007	Bottom	G	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2008	Bottom	G	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2009	Bottom	G	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2010	Bottom	G	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2011	Bottom	H	2	COIL_LK_1608	CHIP COIL 68NH J Q12/100MHZ 0603	68nH	~
L2015	Bottom	I	7	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2016	Bottom	H	7	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2101	Bottom	I	7	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2102	Bottom	I	14	0603L	CHIP COIL 33N J Q40/250MHZ 0603	33nH	~
L2103	Bottom	I	14	0603L	CHIP COIL 33N J Q40/250MHZ 0603	33nH	~
L2104	Bottom	I	8	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2302	Bottom	I	9	CHOKE_SER400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L2309	Bottom	F	10	CHOKE_984FB	CHOKE 22U M 1R4 0.33A 3.3X3.3X1.5	22uH	~
L2800	Top	I	15	0402L	CHIP COIL 33N J Q23/800M 0402	33nH	~
L4000	Top	F	9	0402L	CHIP COIL 2N2 +-0N3 Q30/800M 0402	2n2H	~

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Item	Side	Grid ref.		Type	Description and value		
L4001	Top	F	10	0402L	CHIP COIL 22N J Q28/800M 0402	22nH	~
L4200	Top	I	9	CHOKE_SER400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L4401	Bottom	D	17	0402L	CHIP COIL 33N J Q23/800M 0402	33nH	~
L4425	Top	D	7	0402L_XL	CHIP COIL 68N J Q17/300M 0402	68nH	~
L4430	Top	C	7	0402L	CHIP COIL 33N J Q23/800M 0402	33nH	~
L4435	Top	C	7	0402L	CHIP COIL 33N J Q23/800M 0402	33nH	~
L5500	Bottom	F	8	CHOKE_SER300	INDUCT WW 2.2UH 1A2 310 CASE SIZE	2u2H	~
L6100	Top	J	7	COIL_0603CS	CHIP COIL 47N G Q38/200MHZ 0603	47nH	~
L6101	Bottom	I	6	COIL_LQW160 8	CHIP COIL 120N J Q32/150MHZ 0603	120nH	~
L6500	Top	B	9	CHOKE_SER300	INDUCT WW 2.2UH 1A2 310 CASE SIZE	2u2H	~
L6501	Bottom	C	15	CHOKE_SER300	CHOKE 3.3UH 0R252 0A82 310 CASE SIZE	3u3H	~
L7500	Top	F	17	0402L	CHIP COIL 12N J Q31/800M 0402	12nH	~
L7501	Top	F	17	0402L	CHIP COIL 12N J Q31/800M 0402	12nH	~
L7502	Top	D	15	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L7504	Top	F	16	0402L	CHIP COIL 22N J Q28/800M 0402	22nH	~
L7505	Top	F	17	0402L	CHIP COIL 18N J Q29/800M 0402	18nH	~
L7515	Top	C	17	0402L	CHIP COIL 15N J Q30/800M 0402	15nH	~
L7540	Top	E	14	CHOKE_SER300 _H1.5	CHOKE 3U3 1.2A 0R096 3X3X1.5	3u3H	~
L7580	Top	F	15	0402L	CHIP COIL 2N7 +-0N3 Q29/800M 0402	2n7H	~

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Item	Side	Grid ref.		Type	Description and value		
L7581	Top	E	15	0402L	CHIP COIL 2N7 +-0N3 Q29/800M 0402	2n7H	~
L7582	Top	B	14	0402L	CHIP COIL 18N J Q29/800M 0402	18nH	~
L7583	Top	B	14	0402L	CHIP COIL 4N7 +-0N3 Q28/800M 0402	4n7H	~
L7584	Top	A	14	0402L	CHIP COIL 5N6 +-0N3 Q28/800M 0402	5n6H	~
L7586	Top	D	14	0402L	CHIP COIL 5N6 +-0N3 Q28/800M 0402	5n6H	~
N2200	Bottom	H	8	TFBGA_105	BASEBAND MODULE VILMA 1.04C TFBGA105	~	~
N2300	Bottom	H	9	TFBGA64_H1.2	BETTY V2.1 LF TFBGA64	~	~
N3500	Bottom	G	9	USMD5_1.47X 1.04_H0.675	VREG LP3985ITLX-3.0 NOPB USMD5	~	3V
N3501	Bottom	F	11	PBGA_N48	LEVEL SHIFT SN74AVCA406ZQC R	~	~
N4000	Top	E	10	uBGA63_4.6X4 .6	BRF6150	~	~
N4200	Top	I	11	USMD_10_2.45 8X1.899	DC/DC CONV LM3661-1.40V/ 1.05V NOPB	~	~
N4201	Top	E	11	USMD4_1.313 X1.033	REG LP3990TLX-1.8 NOPB 4BUMPS USMD4	~	1.8V
N4400	Top	I	14	SC_59	HALL IC SWITCH TLE4913 SC 59-3-x	~	~
N4401	Bottom	F	12	SC_59	HALL IC SWITCH TLE4913 SC 59-3-x	~	~
N4405	Top	B	8	USMD5_1.47X 1.04_H0.675	VREG LP3985ITLX-2.8 NOPB USMD5	~	3V
N4406	Top	B	7	TFBGA_42	14XLEVEL SHIFTER ST16C32245TBR uTFBGA42	~	~

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Item	Side	Grid ref.		Type	Description and value		
N4800	Top	H	11	uBGA_289	HELEN3 PS2.0 N3 F761909 C27 UBGA289	~	~
N5500	Top	H	9	LBWA19EBE6	LBWA19EBE6-72*-TEMP-TEMP_ES8 2 1	~	~
N5501	Top	I	7	MLF_6	REG MIC5319YML 500MA ADJ MLF6	~	ADJ
N5502	Bottom	F	7	XBGA_N8_2.02 X1.02	DC/DC CONV TPS6231YZD 1.5V CSP8	~	~
N5503	Top	G	7	LLP_6	REG LP3981YDX 2.8/NOPB 0.3A LLP-6	~	2.8V
N6100	Top	I	7	WFBGA34_2_3. 54X3.54	FM RECEIVER TEA5761UK N3D TI CSP	~	~
N6500	Top	C	9	XBGA_N8_2.02 X1.02	DC/DC CONV TPS6231YZD 1.5V CSP8	~	~
N6501	Top	B	8	LLP6	REG LP3990YDX 1.8V/150MA BUMPED LLP-6	~	~
N6502	Bottom	B	14	TK11892F	STEP-UP DC/DC CONV TK11892F-G-20 SON3024-8	~	~
N6504	Top	B	13	USMD5_1.47X 1.04_H0.675	VREG LP3985ITLX-2.8 NOPB USMD5	~	3V
N7505	Top	E	16	TFBGA144	AHNE301A TRANCEIVER RFIC TFBGA144	~	~
N7520	Top	H	16	RF9282E3.6	PA RF9282E6.3 GSM/EDGE 850/900/1800/19 00	~	~
N7540	Top	D	14	RF9372_H1.5	PA MODULE RF9372E5.2 WCDMA 1850-1980MHZ	~	~
N7541	Top	E	15	uBGA8_1.849X 1.696	DC CONV LM3202TLX NOPB REVB USMD8	~	~

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Item	Side	Grid ref.		Type	Description and value		
R1100	Bottom	H	13	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R1103	Bottom	I	4	0402_NTH5	NTC RES 47K J B=4050+-3% 0402	47k	~
R2000	Bottom	C	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2006	Bottom	H	2	BGA11	ASIP 4 LINES AUDIO FILTER BGA11	~	~
R2007	Bottom	E	2	uBGA11_1.6X2 .15	ASIP SILIC USB OTG / ESD BGA11	~	~
R2009	Bottom	D	2	0402R	Resistor 5% 63mW	220k	~
R2013	Bottom	E	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2014	Bottom	E	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2015	Bottom	F	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2016	Bottom	F	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2017	Bottom	F	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2018	Bottom	F	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2019	Bottom	G	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2020	Bottom	G	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2021	Bottom	G	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2022	Bottom	G	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~

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Item	Side	Grid ref.		Type	Description and value		
R2023	Bottom	G	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2200	Bottom	H	10	0402R	Resistor 5% 63mW	1k0	~
R2303	Bottom	H	10	0402R	Resistor 5% 63mW	18R	~
R2305	Bottom	G	9	0402R	Resistor 5% 63mW	100R	~
R2800	Top	F	14	0402R	Resistor 5% 63mW	10R	~
R2801	Top	I	14	0402R	Resistor 5% 63mW	4k7	~
R2804	Top	F	14	0402R	Resistor 5% 63mW	4k7	~
R2805	Top	F	14	0402R	Resistor 5% 63mW	4k7	~
R3500	Bottom	G	8	0402R	Resistor 5% 63mW	12k	~
R3501	Bottom	F	8	0402R	Resistor 5% 63mW	47R	~
R3502	Bottom	G	8	0402R	Resistor 5% 63mW	47R	~
R3503	Bottom	G	8	0402R	Resistor 5% 63mW	470k	~
R3509	Bottom	G	8	0402R	Resistor 5% 63mW	100k	~
R4400	Top	C	7	0402R	Resistor 5% 63mW	470k	~
R4401	Top	F	9	0402R	Resistor 5% 63mW	100k	~
R4402	Top	C	7	0402R	Resistor 5% 63mW	470k	~
R4403	Top	C	9	0402R	Resistor 5% 63mW	68R	~
R4404	Top	B	9	0402R	Resistor 5% 63mW	180R	~
R4405	Top	D	7	0402R	Resistor 5% 63mW	180R	~
R4410	Top	I	13	0402R	Resistor 5% 63mW	470k	~

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Item	Side	Grid ref.		Type	Description and value		
R4411	Bottom	J	5	0402R	Resistor 5% 63mW	100R	~
R4412	Bottom	J	3	0402R	Resistor 5% 63mW	100R	~
R4413	Bottom	J	5	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4414	Bottom	J	4	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4416	Bottom	D	17	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4420	Bottom	E	12	0402R	Resistor 5% 63mW	470k	~
R4428	Top	D	9	0402R	Resistor 5% 63mW	22R	~
R4429	Top	D	9	0402R	Resistor 5% 63mW	22R	~
R4435	Top	C	7	0402R	Resistor 5% 63mW	47R	~
R4800	Top	H	12	0402R	Resistor 5% 63mW	10R	~
R4801	Top	F	11	0402R	Resistor 5% 63mW	1k0	~
R4802	Top	I	12	0402R	Resistor 5% 63mW	10k	~
R5500	Top	I	7	0402R	CHIPRES 0W06 270K F 200PPM 0402	270k	~
R5502	Top	I	7	0402R	Resistor 5% 63mW	150k	~
R5509	Top	H	7	0402R	Chipres 0W06 jumper 0402	0R	~
R6100	Top	I	8	0402R	Resistor 5% 63mW	10k	~
R6101	Top	J	8	0402R	Resistor 5% 63mW	100k	~
R6102	Top	I	15	0402R	Resistor 5% 63mW	10k	~
R6103	Top	I	15	0402R	Resistor 5% 63mW	10k	~

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Item	Side	Grid ref.		Type	Description and value		
R6503	Bottom	F	16	0402R	Resistor 5% 63mW	1k0	~
R6505	Bottom	B	13	0402R	Resistor 5% 63mW	10k	~
R6506	Bottom	C	13	0402R	Resistor 5% 63mW	10k	~
R6507	Bottom	C	13	0805R	CHIPRES 0W1 56R J 0805	56R	~
R6508	Bottom	C	13	0402R	CHIPRES 0W06 4R3 J 0402	4R3	~
R6509	Bottom	F	16	0402R	Resistor 5% 63mW	10k	~
R6510	Top	C	13	0402R	Resistor 5% 63mW	100R	~
R6511	Bottom	E	16	0402R	Resistor 5% 63mW	10k	~
R6512	Top	C	13	0402R	Resistor 5% 63mW	100R	~
R6513	Top	C	13	0402R	Resistor 5% 63mW	2k2	~
R6514	Bottom	E	16	0402R	Chipres 0W06 jumper 0402	0R	~
R6516	Top	C	13	0402R	Resistor 5% 63mW	100R	~
R6517	Top	B	13	0402R	Resistor 5% 63mW	100R	~
R6518	Bottom	E	16	0402R	Chipres 0W06 jumper 0402	0R	~
R6520	Top	B	13	0402R	Resistor 5% 63mW	10R	~
R7501	Top	D	17	0402R	Resistor 5% 63mW	2k2	~
R7502	Top	E	17	0402R	CHIPRES 0W06 10K F 0402	10k	~
R7503	Top	F	14	0402R	Resistor 5% 63mW	4k7	~
R7505	Top	D	17	0402R	CHIPRES 0W06 8K2 F 0402	8k2	~
R7508	Top	C	16	0402R	Resistor 5% 63mW	10R	~

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Item	Side	Grid ref.		Type	Description and value		
R7509	Top	D	15	0402R	Resistor 5% 63mW	22k	~
R7514	Top	H	15	0402R	Resistor 5% 63mW	15R	~
R7522	Top	G	15	0402R	CHIPRES 0W06 27K F 0402	27k	~
R7540	Top	F	15	0402R	Chipres 0W06 47k F 200ppm 0402	47k	~
R7541	Top	E	15	0402R	CHIPRES 0W06 1K2 F 250PPM 0402	1k2	~
R7542	Top	C	14	0402R	Chipres 0W06 jumper 0402	0R	~
R7543	Top	F	15	0402R	Resistor 5% 63mW	10k	~
R7544	Top	D	15	0402R	Resistor 5% 63mW	10R	~
R7580	Top	E	15	0402R	Resistor 5% 63mW	270R	~
R7588	Top	D	17	0402R	Resistor 5% 63mW	10R	~
R7590	Bottom	D	16	0402R	Resistor 5% 63mW	2k2	~
R7640	Bottom	D	15	0402R	Resistor 5% 63mW	27k	~
R7641	Bottom	D	16	0402R	Resistor 5% 63mW	1k2	~
R7642	Bottom	D	16	0402R	Resistor 5% 63mW	100R	~
R7643	Bottom	E	16	0402R	Resistor 5% 63mW	330R	~
R7644	Top	D	16	0402R	Resistor 5% 63mW	10R	~
S4402	Bottom	J	4	SWITCH_EVQP 7J01C	SWITCH TACT SPST 12V SIDE KEY 1.6N	~	~
T4000	Top	F	9	TRANS_LDB10	BALUN 2450 +-50MHZ 1DB 1.7X0.9	~	~
T7501	Top	D	17	TRANS_LDB15	TRANSF BALUN 3800+-550MHZ 0805	~	~

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Item	Side	Grid ref.		Type	Description and value		
T7520	Top	H	17	TRANS_LDB15	TRANSF BALUN 1800+-100mhz 2x1.25	~	~
T7580	Top	F	17	EHF4BG2450	TRANSF BALUN 1.9GHZ 1.6X0.8	~	~
T7581	Top	E	15	EHF4BG2450	TRANSF BALUN 1.8GHZ 1.6X0.8X0.65	~	~
V2000	Bottom	C	2	BGA4_1.01X1.07	ASIP TVS BGA4	~	~
V2300	Bottom	G	10	DIODE_PMEG3002	SCH DI 30V IF 0A2 UFSM 3A IR 10UA SOD882	~	~
V2301	Bottom	G	9	SOD323F	SCH DI 30V 2A SOD323F	~	~
V4400	Top	G	5	LED_CL_191	LED BLUE 26MCD 5MA CL-191S-HB1R	~	~
V4401	Top	G	2	LED_CL_191	LED BLUE 26MCD 5MA CL-191S-HB1R	~	~
V4402	Top	D	2	LED_CL_191	LED BLUE 26MCD 5MA CL-191S-HB1R	~	~
V4403	Top	D	5	LED_CL_191	LED BLUE 26MCD 5MA CL-191S-HB1R	~	~
V4404	Top	D	7	VMT3	TR 2SC5658QRS N 50V 0A1 0W15 VMT3	~	~
V4405	Top	B	9	VMT3	TR 2SC5658QRS N 50V 0A1 0W15 VMT3	~	~
V6500	Bottom	C	15	DIODE_PMEG3002	SCH DI 30V IF 0A2 UFSM 3A IR 10UA SOD882	~	~
V6502	Bottom	E	16	SOT323	Tr NPN 12V 35mA SOT323	~	~
X1000	Top	I	17	TRACEABILITY_PAD	MODULE ID COMPONENT 2.8X1.8X0.3	~	~
X1100	Bottom	H	12	LYNX_BATT_CONN	SM LYNX BATT.CONN 3POL 12V 2A H7	~	~

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Item	Side	Grid ref.		Type	Description and value		
X2001	Bottom	F	1	SYSCON_MQ202_NK_14R3	SM SYSTEM CONNECTOR 14POL	~	~
X2100	Bottom	A	4	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X2101	Bottom	B	4	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X2102	Bottom	A	3	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X2103	Bottom	B	3	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X2700	Bottom	G	4	SIM_CONN_SP03_14206_04	SM SIM CONN 11POL H2.0	~	~
X3500	Bottom	C	9	MINISD_SC1S011V1S3	CONN MINISD PUSH-PUSH 3.3V 0.5A	~	~
X4400	Top	D	8	MOLEX_SD_500913_0708	CONN BTB 2X35F P0.4	~	~
X4401	Bottom	E	17	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X4402	Bottom	F	17	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X5202	Bottom	B	15	COAX_MM8430	CONN SM COAX+ SW F 50R 250V 6GHZ	~	~
X5203	Bottom	G	16	COAX_MM8430	CONN SM COAX+ SW F 50R 250V 6GHZ	~	~
X5500	Bottom	I	11	COAX_MM8430	CONN SM COAX+ SW F 50R 250V 6GHZ	~	~
X6500	Bottom	F	14	CLE9016_0101E	SM CAMERA MOD SKT 2X8F	~	~
X6501	Bottom	C	14	POGO_CNO_3211_3125H	CONN POGO PINS CNO-3211-3125H H4.3	~	~
Z3500	Bottom	F	9	FLIP_CHIP_16_2.25X2.25	MMC ASP HIGH SPEED BGA16	~	~

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Item	Side	Grid ref.		Type	Description and value		
Z4400	Top	B	10	uBGA25_2.69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4402	Top	B	11	uBGA25_2.69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4403	Top	B	11	uBGA25_2.69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4404	Top	C	7	uBGA25_2.69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z7501	Top	F	17	FILTER_2.1X1.7_10P_H0.6	DUAL RX SAW FILTER 1800/1900MHZ 2016	1800/1900 MHz	~
Z7503	Top	F	16	MODULE_SP_LMZ_137	TX SAW MODULE GSM 850/900MHZ 4.5X3.2	850/900M Hz	~
Z7504	Top	F	16	FILTER_2.1X1.7_10P_H0.6	DUAL RX SAW FILTER 850/900MHZ 2016	850/900M Hz	~
Z7508	Top	E	15	FILTER_2.0X1.6X0.8_4P	SAW FILT 1850-1910MHZ 2X1.6X0.68	1850-1910 MHz	~
Z7520	Top	G	17	FERRITE_FBMJ1608	FERRITE BEAD 0R01 28R/100MHZ 0603	28R/ 100MHz	~
Z7521	Top	H	17	FILTER_LFTC10N	CER FILT LFL181699TC1 2400-2480MHZ 1.6	2400-2483 MHz	~
Z7540	Top	B	15	FILTER_SAW_QCS12E_H1.6	DUPL 1880 +-30MHZ/1960 +-30MHZ 5X5X1.45	1880/1960 MHz	~
Z7580	Top	E	17	FILTER_SAW_2.1X1.7_H0.6_S	SAW FILT 1960 +-30MHZ/ 3.4 2.0X1.6	1960MHz	~

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Component layouts 1ME_09a

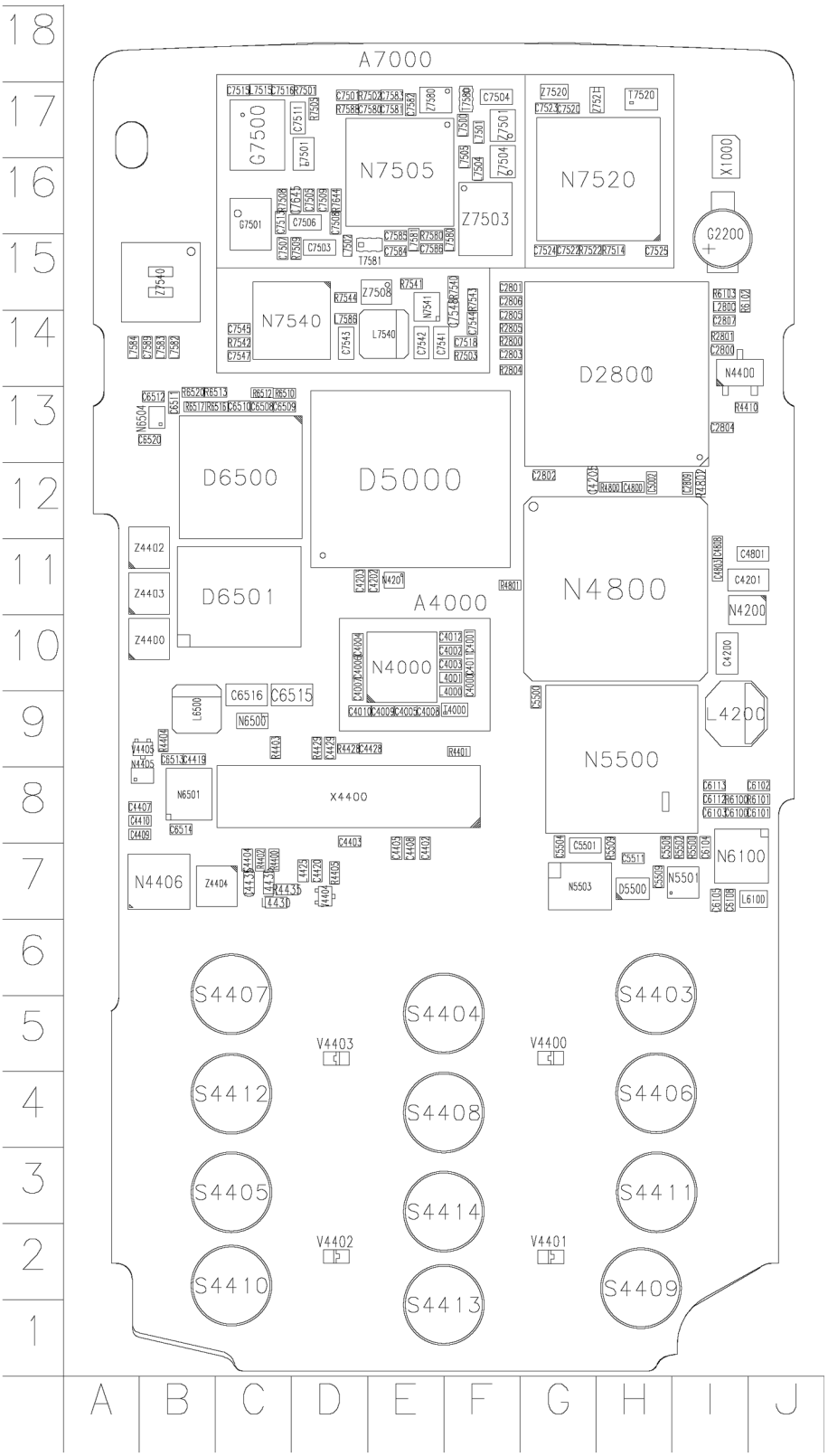

Figure 4 Component layout 1ME_09a top

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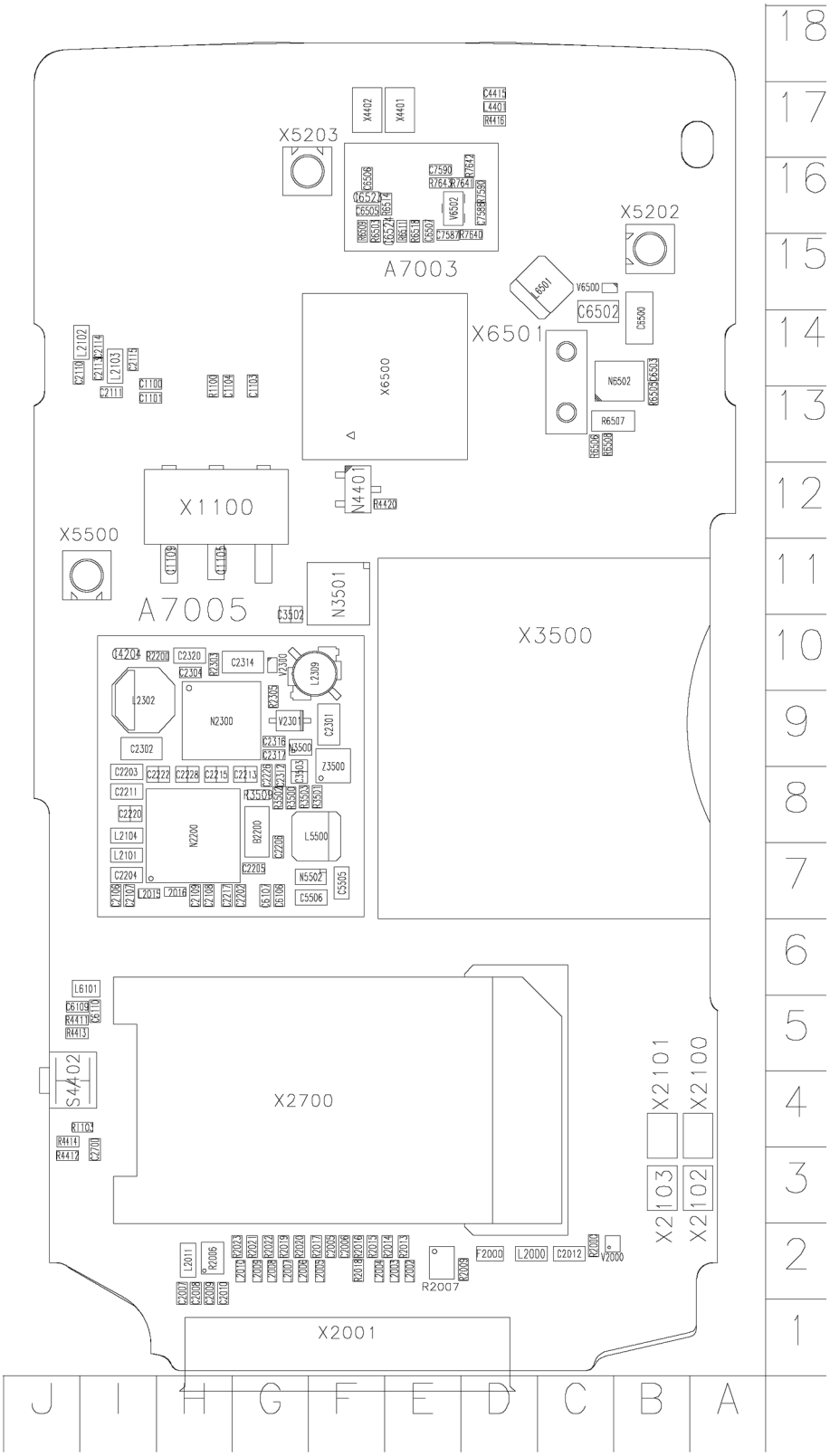

Figure 5 Component layout 1ME_09a bottom

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Component parts list 1ME_09b

Item	Grid ref.	Grid ref.		Type	Description and value		
B2100	Bottom	B	1	MIC_WM_G15CY346	MICROPHONE MOD -42 +-3DB 5X5X3	~	~
B2102	Bottom	H	16	SPEAKER_HF_8203	SPEAKER HF 69+-2DB 8R D16X4.36	~	~
C4418	Top	E	9	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4430	Top	D	7	0402C	Chipcap 5% NP0	15p	50V
C7540	Top	D	15	0402C	Chipcap 5% NP0	10p	50V
R3504	Bottom	F	8	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/ 50V	~
R3505	Bottom	F	8	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/ 50V	~
R3507	Bottom	F	9	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/ 50V	~
R5508	Top	H	7	0402R	Chipres 0W06 jumper 0402	0R	~
R6522	Bottom	E	16	0402R	Chipres 0W06 jumper 0402	0R	~
R7523	Top	H	17	0402R	Chipres 0W06 jumper 0402	0R	~
X2000	Bottom	C	1	CON_JACK_HR33NK_2DJA_2S	CONN DC-JACK 2.0MM 3POL SPR 90DEG	~	~

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Component layouts 1ME_09b

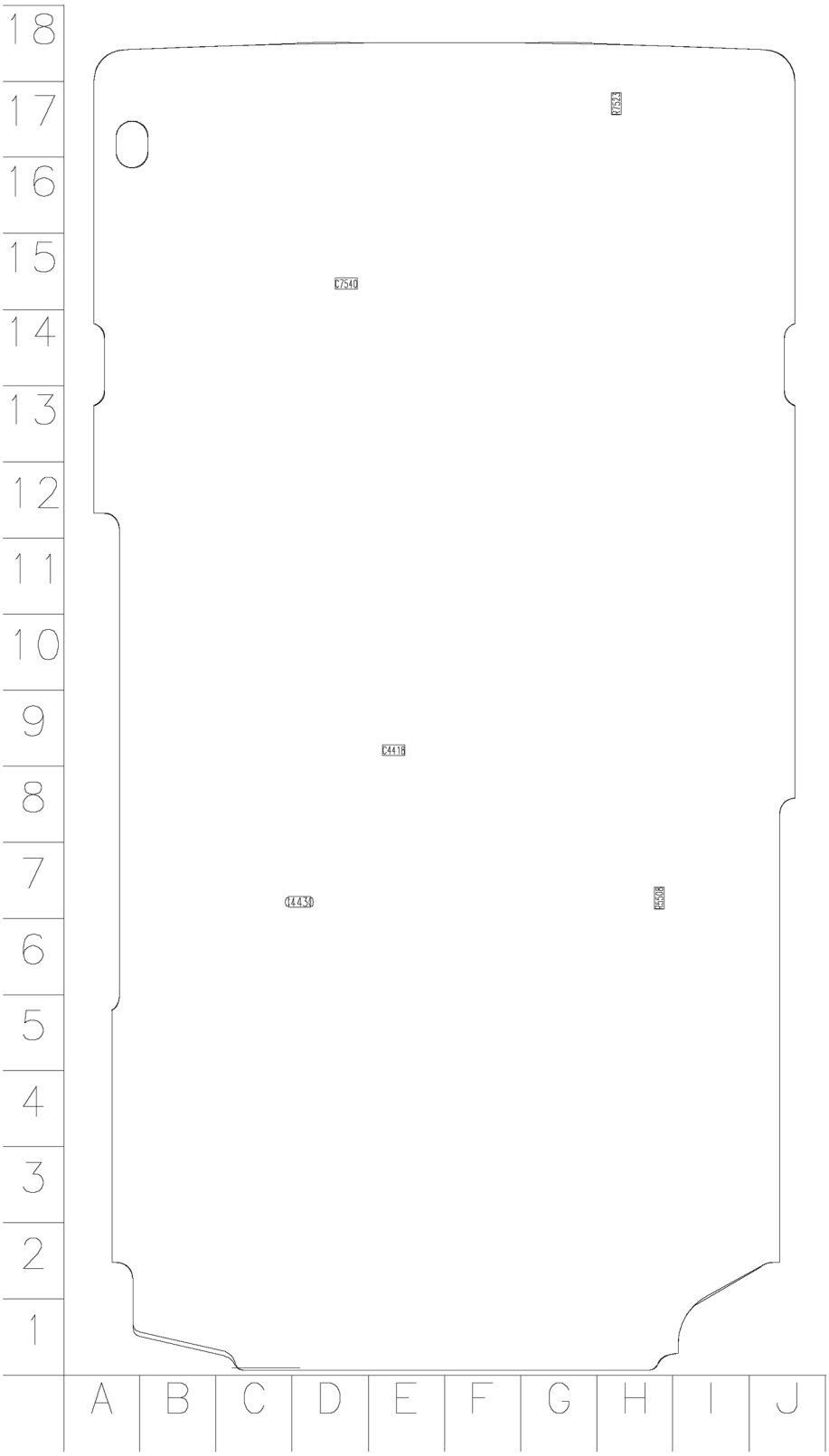

Figure 6 Component layout 1ME_09b top

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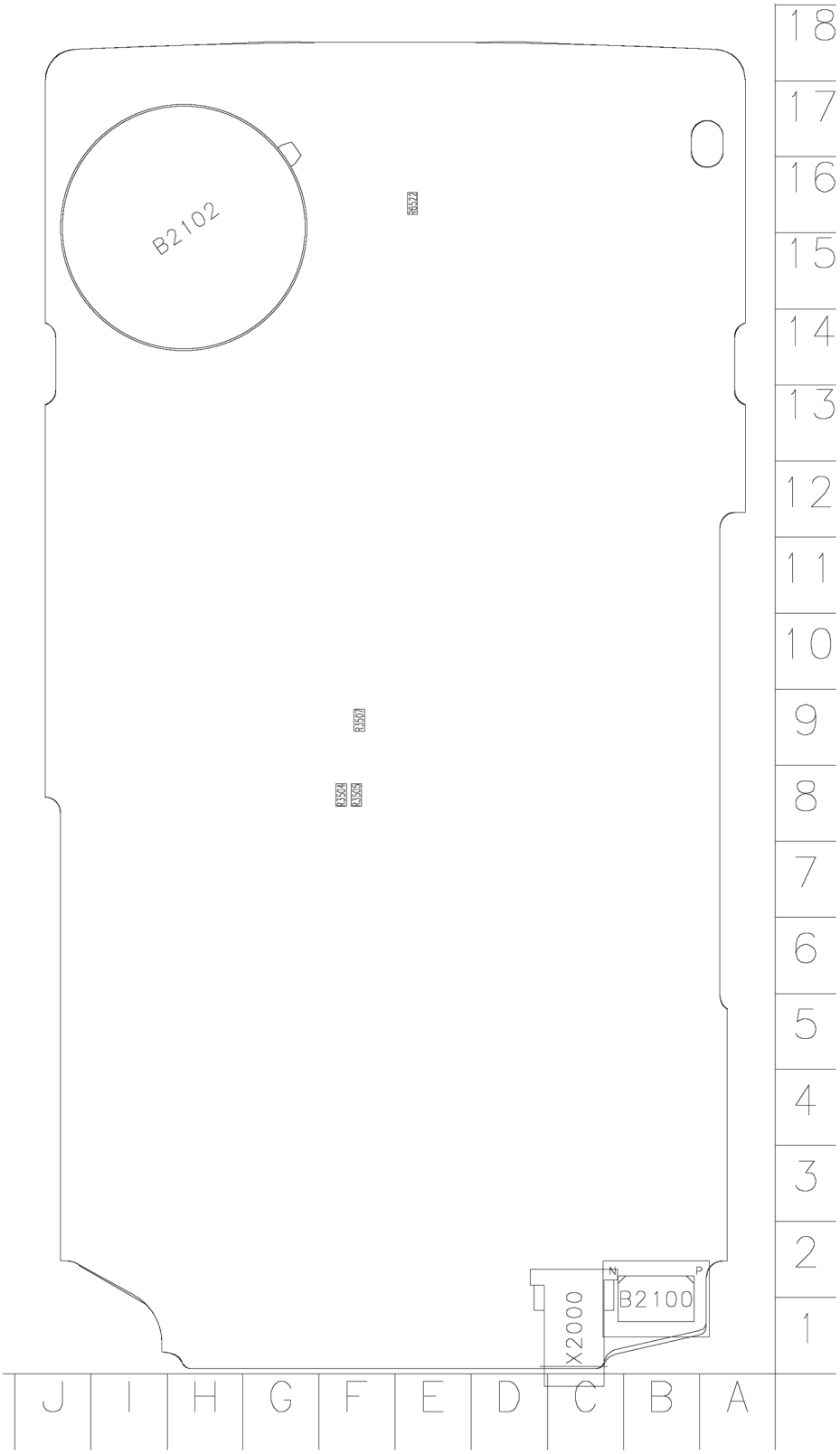

Figure 7 Component layout 1ME_09b bottom

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RM-92 component parts lists and layouts

Component parts list 1NN_07a

Item	Side	Grid ref.		Type	Description and value		
A4000	Top	E	10	MIRO_BT_SHIELD_9590738	SHIELD R1113 BLUETOOTH	~	~
A7000	Top	E	16	MIRO_RF_SHIELD_0264194	SHIELD R1113 RF ASSY	~	~
A7003	Bot	E	16	MIRO_PWR_SHIELD_9590739	SHIELD R1113 POWER SUPPLY	~	~
A7005	Bot	G	8	MIRO_BB_SHIELD_0264195	SHIELD R1113 BB ASSY	~	~
B2200	Bot	G	8	CRYSTAL_3.3X1.6_H0.9	CRYSTAL 32.768KHZ +-20PPM 12.5PF	32.768kHz	~
C1100	Bot	H	14	0402C	Chipcap 5% NP0	10p	50V
C1101	Bot	H	13	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C1103	Bot	G	13	0402C	Chipcap 5% NP0	10p	50V
C1104	Bot	G	13	0402C	Chipcap 5% NP0	10p	50V
C1105	Bot	G	11	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C1109	Bot	H	11	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2005	Bot	F	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2006	Bot	F	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2007	Bot	H	2	0402C	Chipcap 5% NP0	10p	50V
C2008	Bot	H	2	0402C	Chipcap 5% NP0	10p	50V
C2009	Bot	G	2	0402C	Chipcap 5% NP0	10p	50V
C2010	Bot	G	2	0402C	Chipcap 5% NP0	10p	50V
C2012	Bot	C	2	0603C_H0.95	CHIPCAP X5R 1U K 25V 0603	1u0	25V
C2106	Bot	I	7	0402C	Chipcap 5% NP0	56p	50V
C2107	Bot	H	7	0402C	Chipcap 5% NP0	56p	50V
C2108	Bot	G	7	0402C	Chipcap 5% NP0	15p	50V
C2109	Bot	H	7	0402C	Chipcap 5% NP0	15p	50V
C2110	Bot	I	14	0402C	Chipcap 5% NP0	56p	50V
C2111	Bot	I	13	0402C	Chipcap 5% NP0	56p	50V

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Item	Side	Grid ref.		Type	Description and value		
C2113	Bot	I	14	0402C	Chipcap 5% NP0	56p	50V
C2114	Bot	I	14	0402C	Chipcap 5% NP0	56p	50V
C2115	Bot	H	14	0402C	Chipcap 5% NP0	56p	50V
C2202	Bot	G	7	0402C	Chipcap X5R 10% 6.3V 0402	220n	6.3V
C2203	Bot	H	8	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C2204	Bot	H	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C2205	Bot	G	7	0402C	Chipcap X5R 10% 6.3V 0402	220n	6.3V
C2206	Bot	F	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2211	Bot	H	8	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C2213	Bot	G	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2215	Bot	G	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2217	Bot	G	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2220	Bot	H	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2222	Bot	H	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2226	Bot	G	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2228	Bot	H	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C2301	Bot	F	9	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2302	Bot	H	9	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2304	Bot	H	10	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2312	Bot	F	8	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C2314	Bot	G	10	0805C	CHIPCAP X5R 4U7 M 25V 0805	4u7	25V
C2316	Bot	G	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V

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Item	Side	Grid ref.		Type	Description and value		
C2317	Bot	G	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C2320	Bot	H	10	0603C	CHIPCAP X5R 10UF 6V3 0603	10u	4V
C2700	Bot	I	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2800	Top	I	14	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2801	Top	F	15	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2802	Top	F	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2803	Top	F	14	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2804	Top	I	13	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2805	Top	F	14	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2806	Top	F	15	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2807	Top	I	14	0402C	Chipcap 5% NP0	12p	50V
C2809	Top	H	12	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C3502	Bot	F	10	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C3503	Bot	F	8	0405_GNM23	CHIP ARRAY X5R 2X1U K 6V3 MA 0405	2x1u	6.3V
C4000	Top	E	10	0402C	Chipcap 5% NP0	15p	50V
C4001	Top	E	10	0402C	Chipcap 5% NP0	100p	50V
C4002	Top	E	10	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C4003	Top	E	10	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C4004	Top	D	10	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C4005	Top	E	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4006	Top	D	10	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4007	Top	D	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V

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Item	Side	Grid ref.		Type	Description and value		
C4008	Top	E	9	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4009	Top	D	9	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4010	Top	D	9	0402C	CHIPCAP X5R 0U47 K 6.3V 0402	0u47	6V3
C4011	Top	E	10	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C4012	Top	E	10	0402C	CHIPCAP X5R 0U47 K 6.3V 0402	0u47	6V3
C4200	Top	I	10	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4201	Top	I	11	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4202	Top	D	11	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4203	Top	D	11	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4204	Bot	H	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4205	Top	G	12	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4402	Top	E	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4403	Top	D	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4404	Top	B	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4405	Top	D	7	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4407	Top	A	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4408	Top	E	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4409	Top	A	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4410	Top	A	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4418	Top	D	9	0402C	Chipcap X7R 10% 50V 0402	1n0	50V

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Item	Side	Grid ref.		Type	Description and value		
C4419	Top	B	9	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C4420	Top	C	7	0402C	Chipcap 5% NP0	15p	50V
C4428	Top	D	9	0402C	Chipcap 5% NP0	15p	50V
C4429	Top	D	9	0402C	Chipcap 5% NP0	15p	50V
C4435	Top	B	7	0402C	Chipcap 5% NP0	15p	50V
C4800	Top	H	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4801	Top	I	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4803	Top	I	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4808	Top	I	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5002	Top	H	12	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5500	Top	F	9	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C5501	Top	G	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C5504	Top	G	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C5505	Bot	F	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C5506	Bot	F	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C5508	Top	H	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5509	Top	H	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5511	Top	H	7	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6100	Top	I	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6101	Top	I	8	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6102	Top	I	8	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6103	Top	I	8	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V

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Item	Side	Grid ref.		Type	Description and value		
C6104	Top	H	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6105	Top	I	7	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6106	Bot	G	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6107	Bot	G	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6108	Top	I	7	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6109	Bot	I	5	0402C	Chipcap 5% NP0	47p	50V
C6110	Bot	I	5	0402C	Chipcap 5% NP0	27p	50V
C6112	Top	I	8	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6113	Top	I	8	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6500	Bot	B	14	1206C_H1.8	CHIPCAP 2U2 K 25V 1206	2u2	25V
C6502	Bot	B	14	0805C	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3
C6503	Bot	B	14	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6506	Bot	E	16	0402C	Chipcap X5R 10% 6.3V 0402	220n	6.3V
C6508	Top	C	13	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6509	Top	C	13	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C6510	Top	B	13	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6511	Top	B	13	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6512	Top	A	13	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6513	Top	A	9	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6514	Top	B	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6515	Top	C	9	0805C	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3

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Item	Side	Grid ref.		Type	Description and value		
C6516	Top	B	9	0805C	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3
C6520	Top	A	13	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6523	Bot	D	16	0402C	Chipcap 5% NP0	15p	50V
C6524	Bot	E	16	0402C	Chipcap 5% NP0	15p	50V
C7500	Top	C	16	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7501	Top	D	17	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7502	Top	E	17	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7503	Top	C	16	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7504	Top	E	16	0402C	Chipcap 5% X7R	3n9	50V
C7505	Top	F	16	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7506	Bot	E	16	0402C	Chipcap 5% NP0	10p	50V
C7507	Top	C	16	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C7508	Top	B	16	0402C	Chipcap 5% NP0	10p	50V
C7509	Top	C	16	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C7510	Top	C	17	0402C	CHIPCAP NP0 470P J 6V3 0402	470p	6V3
C7511	Top	E	16	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C7512	Top	D	17	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7514	Top	F	17	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7515	Top	F	17	0402C	Chipcap +-0.25pF NP0	3p3	50V
C7516	Top	B	16	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
C7521	Top	F	15	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7541	Top	E	14	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7542	Top	E	14	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V

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Item	Side	Grid ref.		Type	Description and value		
C7543	Top	D	14	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7544	Top	E	14	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C7545	Top	B	14	0402C	Chipcap 5% NP0	10p	50V
C7546	Top	B	14	0402C	Chipcap +-0.25pF NP0	1p0	50V
C7547	Top	D	15	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7550	Top	B	14	0402C	Chipcap X7R 5% 25V 0402	4n7	25V
C7560	Bot	E	16	0402C	Chipcap 5% NP0	100p	50V
C7561	Bot	E	16	0402C	Chipcap X7R 10% 16V 0402	10n	16V
D2800	Top	G	14	VFBGA343	RAP3GS V2.0E-PA VFBGA	~	~
D2801	Top	G	14	FBGA128_EMPTY	COMBO 128M NOR +128M DDR DRAM FBGA128	8Mx16/8Mx16	~
D5000	Top	E	12	FBGA133_11.6X13.1	COMBO 512 DDR + 1G NAND FBGA133 PBFREE	32Mx16/128Mx8	~
D5500	Top	H	7	PDSO_G5	OR-GATE 2INPUT 74LVC1G32 SC70-5	~	~
D6500	Top	B	12	FBGA_195	OMAP DM290 GOLDENEYE NFBGA	~	~
D6501	Top	B	11	WBGA_60_8.1X6.6	SDRAM 4X16 1.8V/1.8V FBGA60 PBFREE	4Mx16	~
F2000	Bot	D	2	0603_FUSE_AVX2MATS	SM FUSE F 2.0A 32V	2A	~
G2200	Top	I	15	BATTER_EECEP	RTC BACUP CAPAC 311 SIZE FOR 2.6V 4UAH	2.6V	~
G7500	Top	E	17	NKG3176B_H1.0	VCTCXO 38.4MHZ 2.5V 2MA	38.4MHz	~
G7501	Top	C	17	VCO_DCS02733	VCO 3296-3980MHZ 4-BAND MATSUSHITA	3296-3980 MHz	~
L2000	Bot	C	2	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2002	Bot	E	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2003	Bot	E	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2004	Bot	E	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~

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Item	Side	Grid ref.		Type	Description and value		
L2005	Bot	F	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2006	Bot	F	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2007	Bot	F	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2008	Bot	G	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2009	Bot	G	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2010	Bot	G	2	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2011	Bot	H	2	COIL_LK_1608	CHIP COIL 68NH J Q12/100MHZ 0603	68nH	~
L2101	Bot	H	7	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2102	Bot	I	14	0603L	CHIP COIL 33N J Q40/250MHZ 0603	33nH	~
L2103	Bot	I	14	0603L	CHIP COIL 33N J Q40/250MHZ 0603	33nH	~
L2104	Bot	H	8	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2105	Bot	H	7	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2106	Bot	H	7	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2302	Bot	H	9	CHOKE_SER400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L2309	Bot	F	10	CHOKE_984FB	CHOKE 22U M 1R4 0.33A 3.3X3.3X1.5	22uH	~
L2800	Top	I	14	0402L	CHIP COIL 33N J Q23/800M 0402	33nH	~
L4000	Top	E	9	0402L	CHIP COIL 2N2+-0N3 Q30/800M 0402	2n2H	~
L4001	Top	E	10	0402L	CHIP COIL 22N J Q28/800M 0402	22nH	~
L4200	Top	I	9	CHOKE_SER400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L4401	Bot	D	17	0402L	CHIP COIL 33N J Q23/800M 0402	33nH	~

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Item	Side	Grid ref.		Type	Description and value		
L4425	Top	C	7	0402L_XL	CHIP COIL 68N J Q17/300M 0402	68nH	~
L4430	Top	C	7	0402L	CHIP COIL 33N J Q23/800M 0402	33nH	~
L4435	Top	C	7	0402L	CHIP COIL 33N J Q23/800M 0402	33nH	~
L5500	Bot	F	8	CHOKE_SER300	INDUCT WW 2.2UH 1A2 310 CASE SIZE	2u2H	~
L6100	Top	I	7	COIL_0603CS	CHIP COIL 47N G Q38/200MHZ 0603	47nH	~
L6101	Bot	I	6	COIL_LQW1608	CHIP COIL 120N J Q32/150MHZ 0603	120nH	~
L6500	Top	B	9	CHOKE_SER300	INDUCT WW 2.2UH 1A2 310 CASE SIZE	2u2H	~
L6501	Bot	C	15	CHOKE_SER300	CHOKE 3.3UH 0R252 0A82 310 CASE SIZE	3u3H	~
L7500	Top	C	16	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L7520	Top	G	15	FERRITE_FBMJ1608	FERRITE BEAD 0R01 28R/100MHZ 0603	28R/ 100MHz	~
L7521	Top	E	14	FERRITE_FBMJ1608	FERRITE BEAD 0R01 28R/100MHZ 0603	28R/ 100MHz	~
L7522	Top	A	14	0402L	CHIP COIL 1N5 +-0N3 Q33/800M 0402	1n5H	~
L7523	Top	A	14	0402L	CHIP COIL 3N9 +-0N3 Q28/800M 0402	3n9H	~
L7540	Top	D	14	CHOKE_SER300_H1.5	CHOKE 3U3 1.2A 0R096 3X3X1.5	3u3H	~
L7543	Top	D	15	0402L	CHIP COIL 3N9 +-0N3 Q28/800M 0402	3n9H	~
N2200	Bot	H	8	TFBGA_105	BASEBAND MODULE VILMA 1.04C TFBGA105	~	~
N2300	Bot	G	9	TFBGA64_H1.2	BETTY V2.1 LF TFBGA64	~	~
N3500	Bot	F	9	USMD5_1.47X1.04_H0.675	VREG LP3985ITLX-3.0 NOPB USMD5	~	3V
N3501	Bot	F	11	PBGA_N48	LEVEL SHIFT SN74AVCA406ZQCR 1.8/3V BGA48	~	~
N4000	Top	E	10	uBGA63_4.6X4.6	BRF6150	~	~

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Item	Side	Grid ref.		Type	Description and value		
N4200	Top	I	11	USMD_10_2.458 X1.899	DC/DC CONV LM3661-1.40V/1.05V NOPB	~	~
N4201	Top	D	11	USMD4_1.313X1. 033	REG LP3990TLX-1.8 NOPB 4BUMPS USMD4	~	1.8V
N4400	Top	I	14	SC_59	HALL IC SWITCH TLE4913 SC 59-3-x	~	~
N4401	Bot	E	12	SC_59	HALL IC SWITCH TLE4913 SC 59-3-x	~	~
N4405	Top	A	8	USMD5_1.47X1.0 4_H0.675	VREG LP3985ITLX-2.8 NOPB USMD5	~	3V
N4406	Top	A	7	TFBGA_42	14XLEVEL SHIFTER ST16C32245TBR uTFBGA42	~	~
N4800	Top	G	11	uBGA_289	HELEN3 PS2.0 N3 F761909 C27 UBGA289	~	~
N5500	Top	G	9	LBWA19EBE6	LBWA19EBE6-72*- TEMP-TEMP_ES8 2 1	~	~
N5501	Top	H	7	MLF_6	REG MIC5319YML 500MA ADJ MLF6	~	ADJ
N5502	Bot	F	7	XBGA_N8_2.02X1 .02	DC/DC CONV TPS6231YZD 1.5V CSP8	~	~
N5503	Top	G	7	LLP_6	REG LP3981YDX 2.8/ NOPB 0.3A LLP-6	~	2.8V
N6100	Top	I	7	WFBGA34_2_3.5 4X3.54	FM RECEIVER TEA5761UK N3D TI CSP	~	~
N6500	Top	C	9	XBGA_N8_2.02X1 .02	DC/DC CONV TPS6231YZD 1.5V CSP8	~	~
N6501	Top	B	8	LLP6	REG LP3990YDX 1.8V/ 150MA BUMPED LLP-6	~	~
N6502	Bot	B	14	TK11892F	STEP-UP DC/DC CONV TK11892F-G-20 SON3024-8	~	~
N6504	Top	A	13	USMD5_1.47X1.0 4_H0.675	VREG LP3985ITLX-2.8 NOPB USMD5	~	3V
N7500	Top	D	16	TFBGA_188	RF SYSTEM MODULE PIHI2.22 9.0X9.0X1	~	~
N7520	Top	G	16	RF9282E3.6	PA RF9282E6.3 GSM/ EDGE 850/900/1800/1900	~	~
N7540	Top	C	14	RF9372_H1.5	PA MODULE RF9372E5.2 WCDMA 1850-1980MHZ	~	~

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Item	Side	Grid ref.		Type	Description and value		
N7541	Top	E	15	uBGA8_1.849X1.696	DC CONV LM3202TLX NOPB REVB USMD8	~	~
R1100	Bot	G	13	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R1103	Bot	I	4	0402_NTH5	NTC RES 47K J B=4050 +-3% 0402	47k	~
R2000	Bot	B	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2006	Bot	G	2	BGA11	ASIP 4 LINES AUDIO FILTER BGA11	~	~
R2007	Bot	D	2	uBGA11_1.6X2.15	ASIP SILIC USB OTG / ESD BGA11	~	~
R2009	Bot	D	2	0402R	Resistor 5% 63mW	220k	~
R2013	Bot	E	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2014	Bot	E	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2015	Bot	E	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2016	Bot	E	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2017	Bot	F	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2018	Bot	F	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2019	Bot	F	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2020	Bot	F	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2021	Bot	G	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2022	Bot	G	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2023	Bot	G	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2200	Bot	H	10	0402R	Resistor 5% 63mW	1k0	~
R2303	Bot	G	10	0402R	Resistor 5% 63mW	18R	~
R2305	Bot	G	9	0402R	Resistor 5% 63mW	100R	~
R2800	Top	F	14	0402R	Resistor 5% 63mW	10R	~
R2801	Top	I	14	0402R	Resistor 5% 63mW	4k7	~

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Item	Side	Grid ref.		Type	Description and value		
R2804	Top	F	14	0402R	Resistor 5% 63mW	4k7	~
R2805	Top	F	14	0402R	Resistor 5% 63mW	4k7	~
R3500	Bot	F	8	0402R	Resistor 5% 63mW	12k	~
R3501	Bot	F	8	0402R	Resistor 5% 63mW	47R	~
R3502	Bot	F	8	0402R	Resistor 5% 63mW	47R	~
R3503	Bot	F	8	0402R	Resistor 5% 63mW	470k	~
R3509	Bot	G	8	0402R	Resistor 5% 63mW	100k	~
R4400	Top	C	7	0402R	Resistor 5% 63mW	470k	~
R4401	Top	E	9	0402R	Resistor 5% 63mW	100k	~
R4402	Top	C	7	0402R	Resistor 5% 63mW	470k	~
R4403	Top	C	9	0402R	Resistor 5% 63mW	68R	~
R4404	Top	A	9	0402R	Resistor 5% 63mW	180R	~
R4405	Top	D	7	0402R	Resistor 5% 63mW	180R	~
R4410	Top	I	13	0402R	Resistor 5% 63mW	470k	~
R4411	Bot	I	5	0402R	Resistor 5% 63mW	100R	~
R4412	Bot	I	3	0402R	Resistor 5% 63mW	100R	~
R4413	Bot	I	5	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4414	Bot	I	4	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4416	Bot	D	17	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4420	Bot	E	12	0402R	Resistor 5% 63mW	470k	~
R4428	Top	D	9	0402R	Resistor 5% 63mW	22R	~
R4429	Top	C	9	0402R	Resistor 5% 63mW	22R	~
R4435	Top	C	7	0402R	Resistor 5% 63mW	47R	~
R4800	Top	G	12	0402R	Resistor 5% 63mW	10R	~
R4801	Top	F	11	0402R	Resistor 5% 63mW	1k0	~
R4802	Top	H	12	0402R	Resistor 5% 63mW	10k	~
R5500	Top	H	7	0402R	CHIPRES 0W06 270K F 200PPM 0402	270k	~
R5502	Top	H	7	0402R	Resistor 5% 63mW	150k	~
R5509	Top	G	7	0402R	Chipres 0W06 jumper 0402	0R	~
R6100	Top	I	8	0402R	Resistor 5% 63mW	10k	~
R6101	Top	I	8	0402R	Resistor 5% 63mW	100k	~

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Item	Side	Grid ref.		Type	Description and value		
R6102	Top	I	15	0402R	Resistor 5% 63mW	10k	~
R6103	Top	I	15	0402R	Resistor 5% 63mW	10k	~
R6503	Bot	D	16	0402R	Resistor 5% 63mW	1k0	~
R6505	Bot	C	13	0402R	Resistor 5% 63mW	10k	~
R6506	Bot	B	13	0402R	Resistor 5% 63mW	10k	~
R6507	Bot	B	13	0805R	CHIPRES 0W1 56R J 0805	56R	~
R6508	Bot	B	14	0402R	CHIPRES 0W06 4R3 J 0402	4R3	~
R6509	Bot	E	16	0402R	Resistor 5% 63mW	10k	~
R6510	Top	C	13	0402R	Resistor 5% 63mW	100R	~
R6511	Bot	E	16	0402R	Resistor 5% 63mW	10k	~
R6512	Top	C	13	0402R	Resistor 5% 63mW	100R	~
R6513	Top	B	13	0402R	Resistor 5% 63mW	2k2	~
R6514	Bot	D	16	0402R	Chipres 0W06 jumper 0402	0R	~
R6516	Top	B	13	0402R	Resistor 5% 63mW	100R	~
R6517	Top	B	13	0402R	Resistor 5% 63mW	100R	~
R6518	Bot	D	16	0402R	Chipres 0W06 jumper 0402	0R	~
R6520	Top	B	13	0402R	Resistor 5% 63mW	10R	~
R7500	Top	F	16	0402R	Resistor 5% 63mW	22k	~
R7501	Top	B	16	0402R	Resistor 5% 63mW	4k7	~
R7503	Top	B	17	0402R	CHIPRES 0W06 1K0 F 200PPM 0402	1k0	~
R7504	Top	D	17	0402R	CHIPRES 0W06 8K2 F 0402	8k2	~
R7505	Top	B	16	0402R	Chipres 0W06 5R6 J 0402	5R6	~
R7520	Top	G	15	0402R	CHIPRES 0W06 27K F 0402	27k	~
R7540	Top	D	15	0402R	Chipres 0W06 47k F 200ppm 0402	47k	~
R7541	Top	E	15	0402R	CHIPRES 0W06 1K0 F 200PPM 0402	1k0	~
R7542	Top	B	14	0402R	Chipres 0W06 jumper 0402	0R	~
R7543	Top	E	15	0402R	Resistor 5% 63mW	10k	~

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Item	Side	Grid ref.		Type	Description and value		
R7544	Top	D	14	0402R	Resistor 5% 63mW	10R	~
R7560	Bot	E	16	0402R	Resistor 5% 63mW	330R	~
R7561	Bot	E	16	0402R	Resistor 5% 63mW	27k	~
R7562	Bot	D	16	0402R	Resistor 5% 63mW	1k2	~
R7563	Bot	E	16	0402R	Resistor 5% 63mW	2k2	~
R7571	Top	E	15	0402R	Resistor 5% 63mW	4k7	~
R7593	Bot	D	16	0402R	Resistor 5% 63mW	100R	~
S4402	Bot	I	4	SWITCH_EVQP7J01C	SWITCH TACT SPST 12V SIDE KEY 1.6N	~	~
T4000	Top	E	9	TRANS_LDB10	BALUN 2450+-50MHZ 1DB 1.7X0.9	~	~
T7500	Top	C	15	TRANS_LDB15	TRANSF BALUN 2134 +-90MHZ 0805	~	~
T7501	Top	C	17	TRANS_LDB15	TRANSF BALUN 3800 +-550MHZ 0805	~	~
V2000	Bot	B	2	BGA4_1.01X1.07	ASIP TVS BGA4	~	~
V2300	Bot	G	10	DIODE_PMEG3002	SCH DI 30V IF 0A2 UFSM 3A IR 10UA SOD882	~	~
V2301	Bot	F	9	SOD323F	SCH DI 30V 2A SOD323F	~	~
V4400	Top	F	5	LED_CL_191	LED BLUE 26MCD 5MA CL-191S-HB1R	~	~
V4401	Top	F	2	LED_CL_191	LED BLUE 26MCD 5MA CL-191S-HB1R	~	~
V4402	Top	D	2	LED_CL_191	LED BLUE 26MCD 5MA CL-191S-HB1R	~	~
V4403	Top	D	5	LED_CL_191	LED BLUE 26MCD 5MA CL-191S-HB1R	~	~
V4404	Top	C	7	VMT3	TR 2SC5658QRS N 50V 0A1 0W15 VMT3	~	~
V4405	Top	A	9	VMT3	TR 2SC5658QRS N 50V 0A1 0W15 VMT3	~	~
V6500	Bot	B	15	DIODE_PMEG3002	SCH DI 30V IF 0A2 UFSM 3A IR 10UA SOD882	~	~
V7560	Bot	D	16	SOT323	Tr NPN 12V 35mA SOT323	~	~
X1	Bot	F	16	COAX_MM8430	SM COAX CONN+SW F 50R 250V 6GHZ	~	~
X1000	Top	I	16	TRACEABILITY_PAD	MODULE ID COMPONENT 2.8X1.8X0.3	~	~

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Item	Side	Grid ref.		Type	Description and value		
X1100	Bot	G	12	LYNX_BATT_CON N	SM LYNX BATT.CONN 3POL 12V 2A H7	~	~
X2001	Bot	F	1	SYSCON_MQ202_ NK_14R3	SM SYSTEM CONNECTOR 14POL	~	~
X2100	Bot	A	4	CONTACT_PAD_2. 95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X2101	Bot	A	4	CONTACT_PAD_2. 95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X2102	Bot	A	3	CONTACT_PAD_2. 95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X2103	Bot	A	3	CONTACT_PAD_2. 95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X2700	Bot	F	4	SIM_CONN_SP03_ 14206_04	SM SIM CONN 11POL H2.0	~	~
X3500	Bot	C	9	MINISD_SC1S011 V1S3	CONN MINISD PUSH-PUSH 3.3V 0.5A	~	~
X4400	Top	D	8	MOLEX_SD_5009 13_0708	CONN BTB 2X35F P0.4	~	~
X4401	Bot	E	17	CONTACT_PAD_2. 95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X4402	Bot	E	17	CONTACT_PAD_2. 95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X5500	Bot	I	11	COAX_MM8430	SM COAX CONN+SW F 50R 250V 6GHZ	~	~
X6500	Bot	E	14	CLE9016_0101E	SM CAMERA MOD SKT 2X8F	~	~
X6501	Bot	C	14	POGO_CNO_3211 _3125H	CONN POGO PINS CNO-3211-3125H H4.3	~	~
X6502	Bot	B	15	COAX_MM8430	SM COAX CONN+SW F 50R 250V 6GHZ	~	~
Z3500	Bot	F	8	FLIP_CHIP_16_2. 01X2.02_H0.715	MMC ASP HIGH SPEED BGA16	~	~
Z4400	Top	A	10	uBGA25_2.47X2. 47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4402	Top	A	11	uBGA25_2.47X2. 47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4403	Top	A	11	uBGA25_2.47X2. 47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4404	Top	B	7	uBGA25_2.47X2. 47	ASIP 10-CH ESD EMI FILTER BGA25	~	~

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Item	Side	Grid ref.		Type	Description and value		
Z7500	Top	F	16	MODULE_SP_LMZ_137	TX SAW MODULE GSM 850/900MHZ	850/900MHz	~
Z7501	Top	H	17	FILTER_LFTC10N	CER FILT LFL181699TC1 2400-2480MHZ 1.6	2400-2483 MHz	~
Z7540	Top	A	15	P_TC3N_12_1_AGI	DUPL BAW 1920-1980/2110-2170 MHZ 3.8X3.8	1920-1980 / 2110-2170 MHZ	~

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Component layouts 1NN_07a

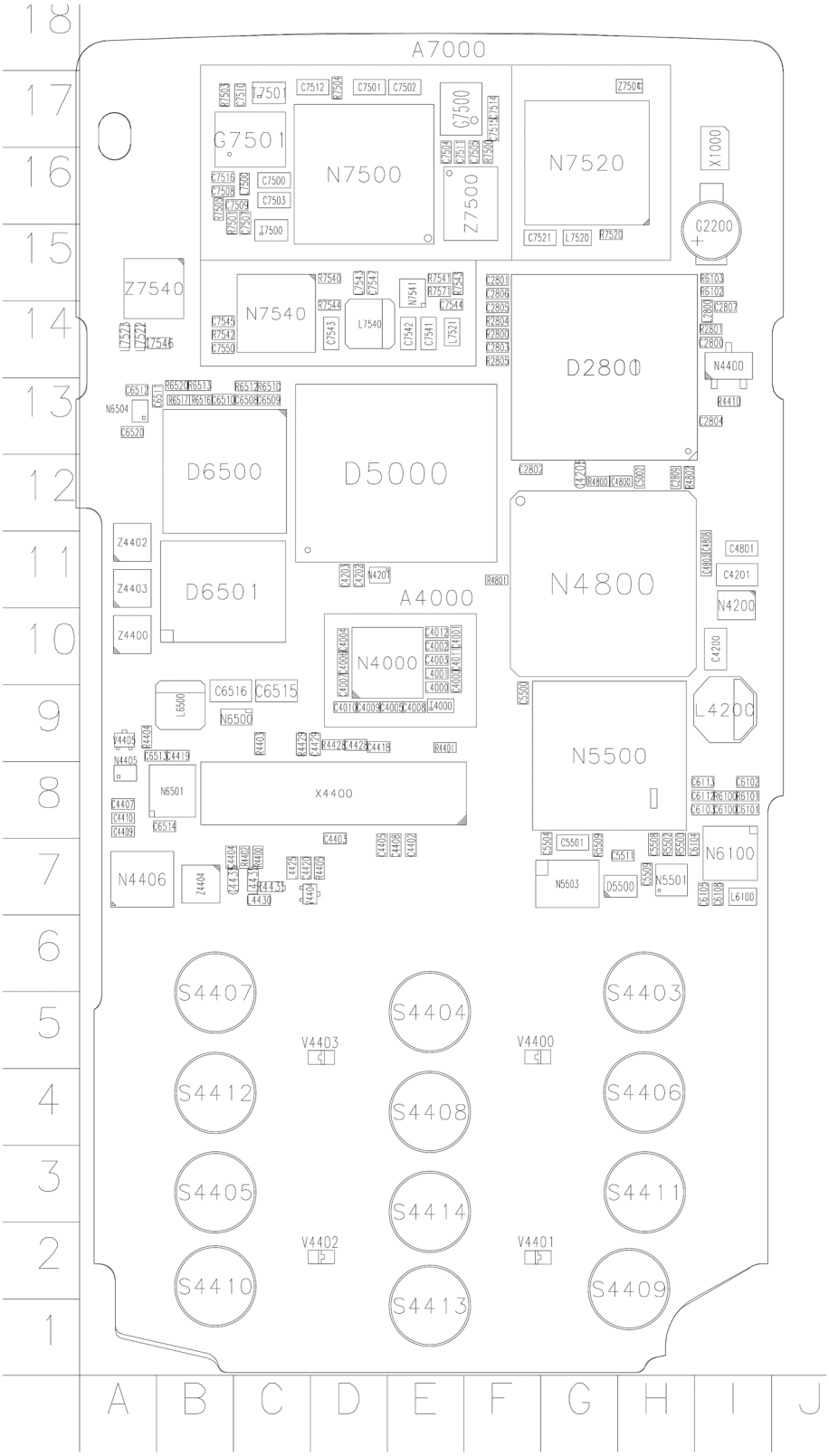

Figure 8 Component layout top 1NN_07a

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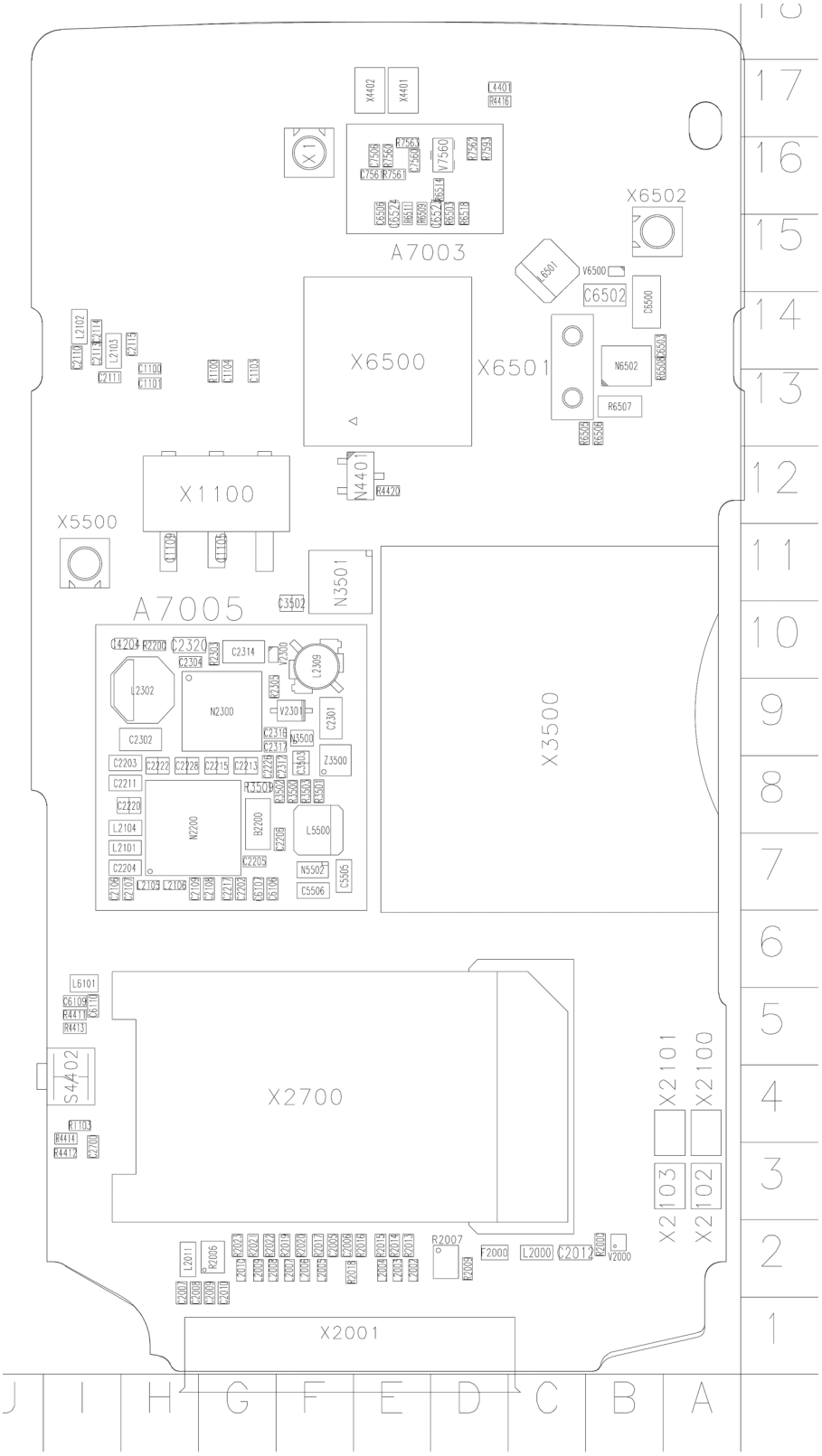

Figure 9 Component layout bottom 1NN_07a

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Component parts list 1NN_07b

Item	Side	Grid ref.		Type	Description and value		
B2100	Bottom	B	1	MIC_WM_G 15CY346	MICROPHONE MOD -42 +-3DB 5X5X3	~	~
B2102	Bottom	H	16	SPEAKER_HF_8203	SPEAKER HF 69+-2DB 8R D16X4.36	~	~
C4430	Top	C	7	0402C	Chipcap 5% NP0	15p	50V
C6505	Bottom	E	16	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6507	Bottom	D	16	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C7522	Top	G	17	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7523	Top	F	17	0402C	CHIPCAP N750 1P8 C 50V 0402	1p8	50V
C7540	Top	D	15	0402C	Chipcap 5% NP0	10p	50V
L7541	Top	G	17	0402L	CHIP COIL 3N3 +-0N3 Q28/800M 0402	3n3H	~
L7544	Top	H	17	0402L	CHIP COIL 3N3 +-0N3 Q28/800M 0402	3n3H	~
R3504	Bottom	F	8	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R3505	Bottom	F	8	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~

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Item	Side	Grid ref.		Type	Description and value		
R3507	Bottom	F	9	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R5508	Top	H	7	0402R	Chipres 0W06 jumper 0402	0R	~
R6522	Bottom	D	16	0402R	Chipres 0W06 jumper 0402	0R	~
X2000	Bottom	C	1	CON_JACK_HR33NK_2DJA_2S	CONN DC-JACK 2.0MM 3POL SPR 90DEG	~	~

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Component layouts 1NN_07b

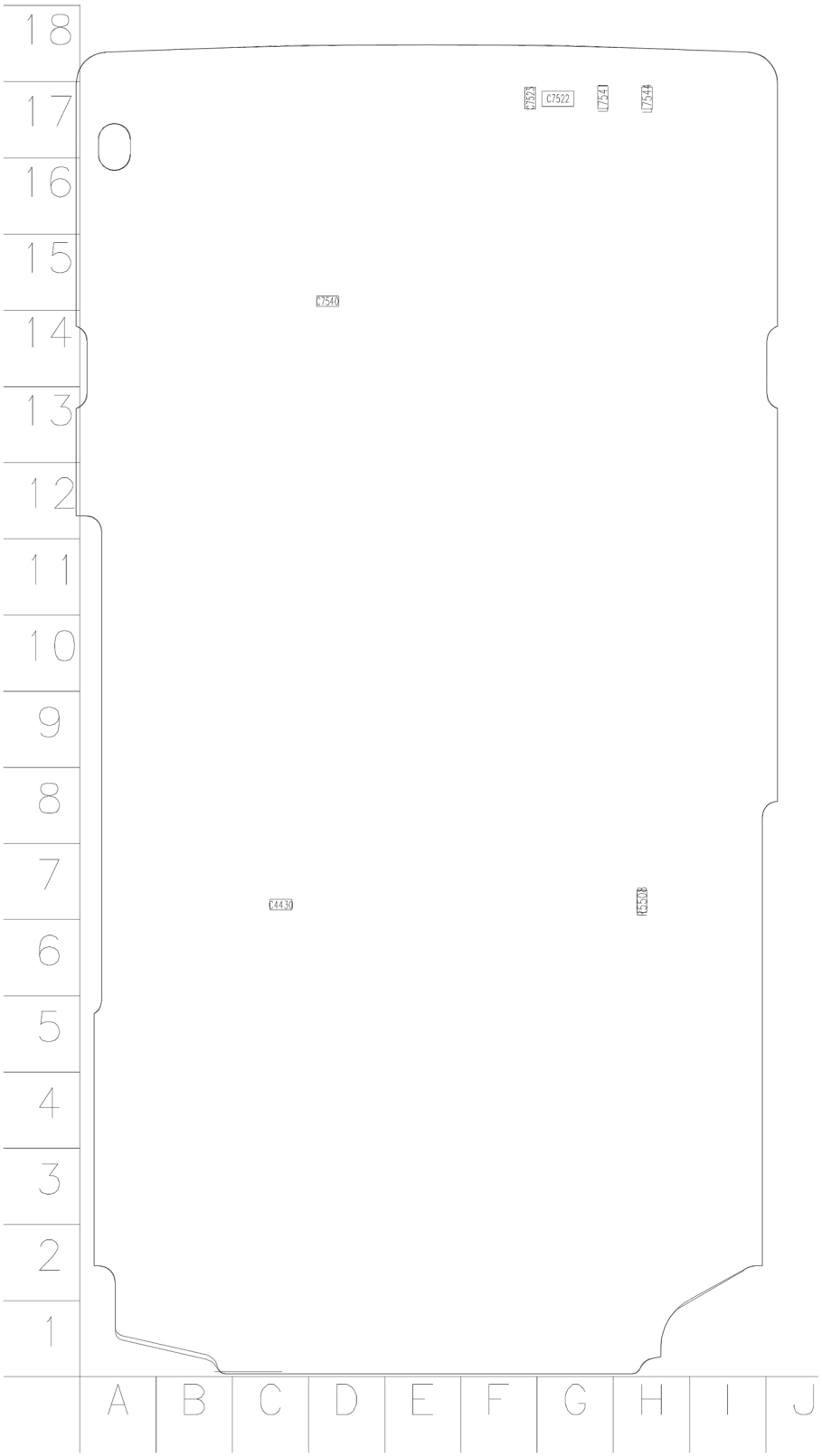

Figure 10 Component layout top 1NN_07b

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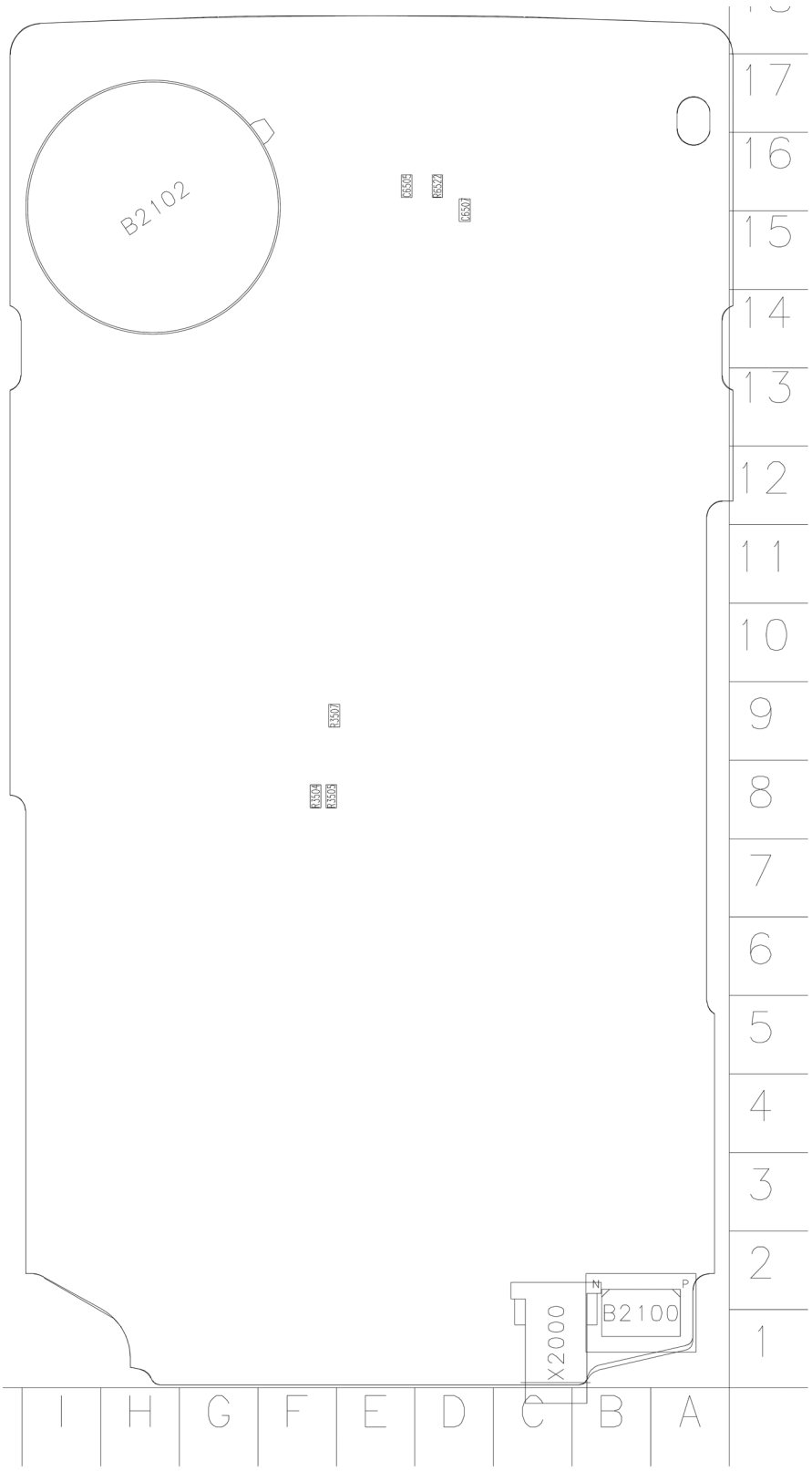

Figure 11 Component layout bottom 1NN_07b

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3 — Service Software Instructions

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Phoenix installation steps in brief

Before you begin

Recommended hardware requirements:

- Computer processor: Pentium 700 MHz or higher
- RAM 256 MB
- Disk space 100-300 MB

Supported operating systems:

- *Windows 2000* Service Pack 3 or higher
- *Windows XP* Service Pack 1 or higher

Context

Phoenix is a service software for reprogramming, testing and tuning phones.

Phoenix installation contains:

- Service software support for all phone models included in the package
- Flash update package files for programming devices
- All needed drivers for:
  - PKD-1 (DK2) dongle
  - DKU-2 USB cable

    Note: Separate installation packages for flash update files and drivers are also available, but it is not necessary to use them unless there are updates between *Phoenix* service software releases. If separate update packages are used, they should be used after *Phoenix* and data packages have been installed.

The phone model specific data package includes all changing product specific data:

- Product software binary files
- Files for type label printing
- Validation file for the faultlog repair data reporting system
- All product specific configuration files for *Phoenix* software components

  Note: *Phoenix* and phone data packages should only be used as complete installation packages. Uninstallation should be made from the *Windows* Control Panel.

To use *Phoenix*, you need to:

Steps

1. Connect a PKD-1 (DK2) dongle to the computer parallel port.
2. Install *Phoenix*.
3. Install the phone-specific data package.
4. Configure users.
5. Manage connection settings (depends on the tools you are using).
   - Update FPS-10 software

     Note: There is no need to activate FPS-10.
   - Activate SX-4 smart card, if you need tuning and testing functions.

     Note: When FPS-10 is used only for product software updates, SX-4 smart card is not needed.

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Results

Phoenix is ready to be used with FPS-10 flash prommer and other service tools.

Installing *Phoenix*

Before you begin

- Check that a dongle is attached to the parallel port of your computer.
- Download the *Phoenix* installation package (for example, *phoenix_service_sw_2004_39_x_xx.exe*) to your computer (in *C:|TEMP*, for instance).
- Close all other programs.
- Depending on your operating system, administrator rights may be required to install *Phoenix*.
- If uninstalling or rebooting is needed at any point, you will be prompted by the InstallShield program.

Context

At some point during the installation procedure, you may get the following message:

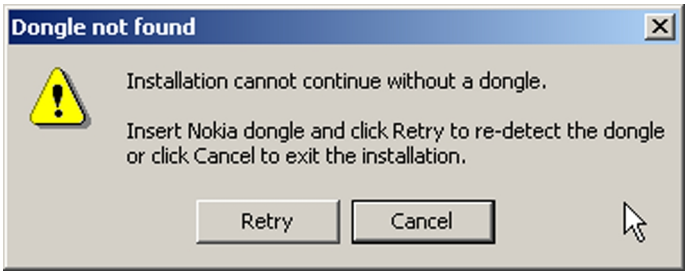

Figure 12 Dongle not found

This may be a result of a defective or too old PKD-1 dongle.

Check the COM/parallel ports used. After correcting the problem, you can restart the installation.

For more detailed information, please refer to *Phoenix* Help files.

> **Tip:** Each feature in *Phoenix* has its own Help function, which can be activated while running the program. Press the **F1** key or the feature's **Help** button to activate a Help file.

Steps

1. To start the installation, run the application file (for example,*phoenix_service_sw_2004_39_x_xx.exe*).
2. In the *Welcome* dialogue, click **Next**.

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3. Read the disclaimer text carefully and click **Yes**.

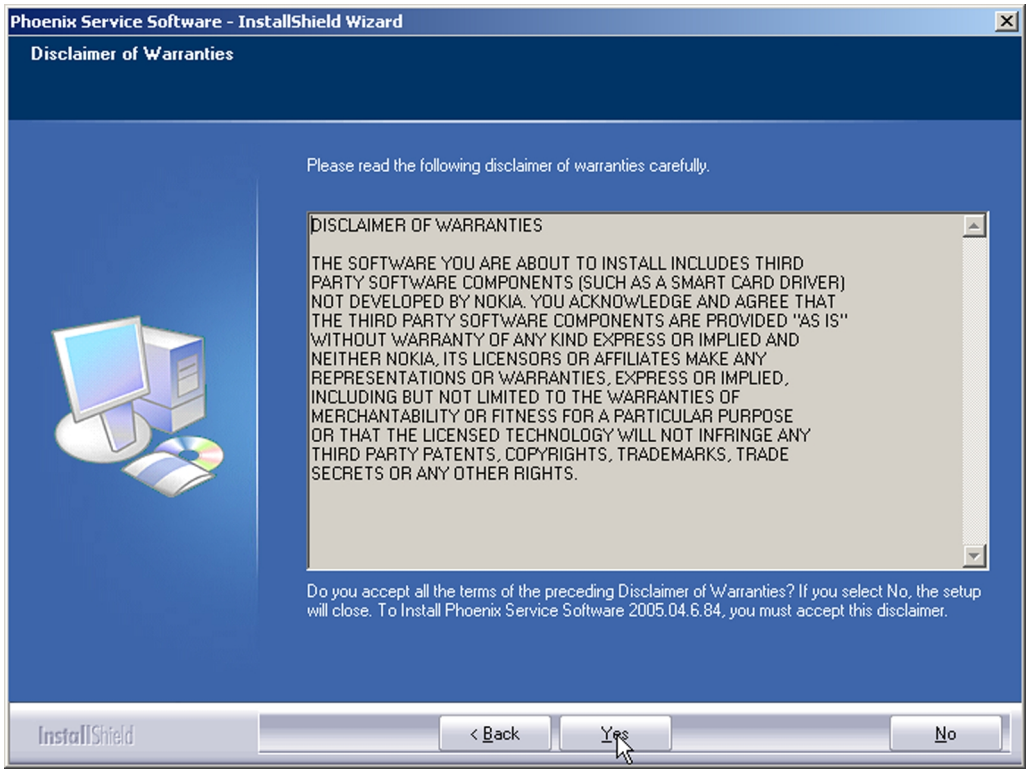

Figure 13 Disclaimer text

4. Choose the destination folder.
   The default folder *C:|ProgramFiles|Nokia|Phoenix* is recommended.
5. To continue, click **Next.**
   To choose another location, click **Browse** (not recommended).
6. Wait for the components to be copied.
   The progress of the installation is shown in the *Setup Status* window.
7. Wait for the drivers to be installed and updated.
   The process may take several minutes to complete.
   If the operating system does not require rebooting, the PC components are registered right away.
   If the operating system requires restarting your computer, the Install Shield Wizard will notifies about it.
   Select **Yes...** to reboot the PC immediately or **No...** to reboot the PC manually afterwards.
   After the reboot, all components are registered.

   Note: *Phoenix* does not work, if the components have not been registered.

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8. To end the installation, click **Finish**.

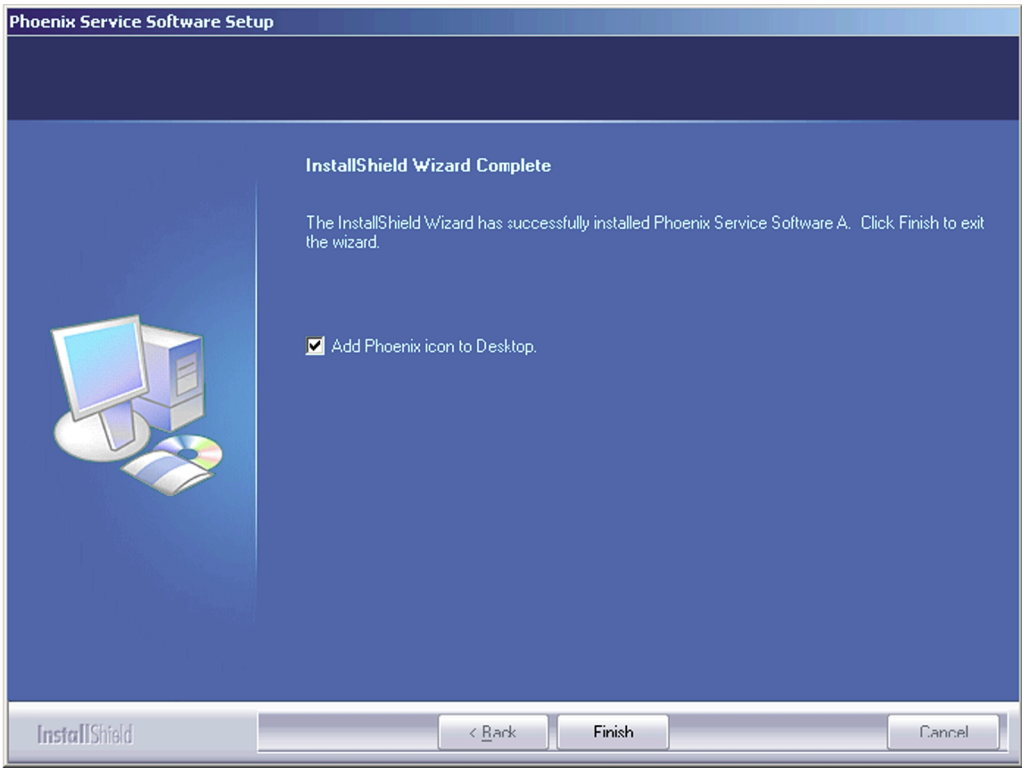

Figure 14 InstallShield Wizard Complete

Next action

After the installation, *Phoenix* can be used after:

- installing phone model specific data package for *Phoenix*
- configuring users and connections

FPS-10 flash prommer can be used after updating their flash update package files.

Updating *Phoenix* installation

Context

- If you already have the *Phoenix* service software installed on your computer, you need to update the software when new versions are released.
- To update *Phoenix*, you need to follow the same steps as when installing it for the first time.
- When you are updating, for example, from version **a14_2004_16_4_47** to **a15_2004_24_7_55**, the update will take place automatically without uninstallation.
- Always use the latest available versions of both *Phoenix* and the phone-specific data package. Instructions can be found in the phone model specific Technical Bulletins and phone data package *readme.txt* files (shown during installation).
- If you try to update *Phoenix* with the same version you already have (for example, **a15_2004_24_7_55** to **a15_2004_24_7_55**), you are asked if you want to uninstall the existing version. In this case you can choose between a total uninstallation or a repair installation in a similar way when choosing to uninstall the application from the *Windows* Control Panel.
- If you try to install an older version (for example, downgrade from **a15_2004_24_7_55** to **a14_2004_16_4_47**), installation will be interrupted.

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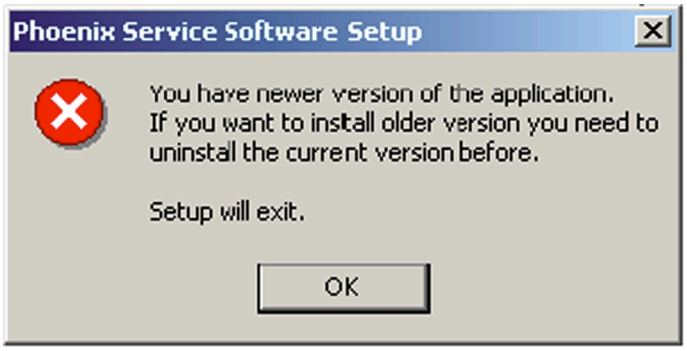

Figure 15 Installation interrupted

- Always follow the instructions on the screen.

Steps

1. Download the installation package to your computer hard disk.
2. Close all other programs.
3. Run the application file (for example, *phoenix_service_sw_2004_39_x_xx.exe*).

Results

A new *Phoenix* version is installed and driver versions are checked and updated.

Uninstalling *Phoenix*

Context

You can uninstall *Phoenix* service software manually from the *Windows* Control Panel.

Steps

1. Open the **Windows Control Panel**, and choose **Add/Remove Programs**.

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2. To uninstall *Phoenix*, choose **Phoenix Service Software→Change/Remove→Remove** .

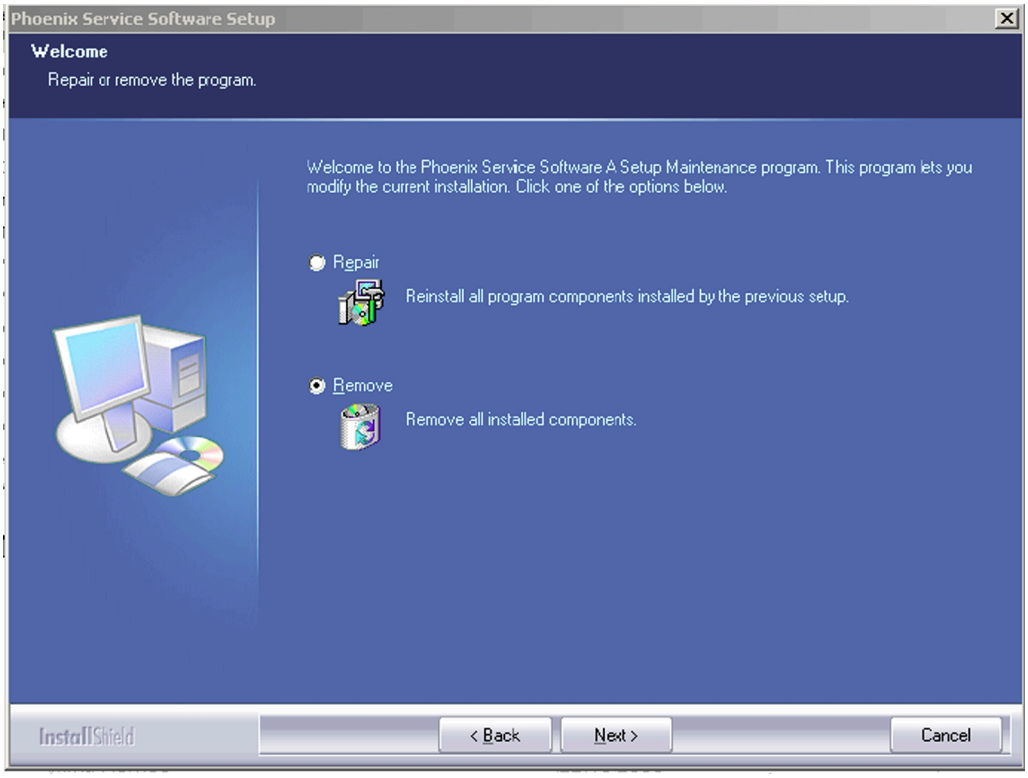

Figure 16 Remove program

The progress of the uninstallation is shown.

3. If the operating system does not require rebooting, click **Finish** to complete.

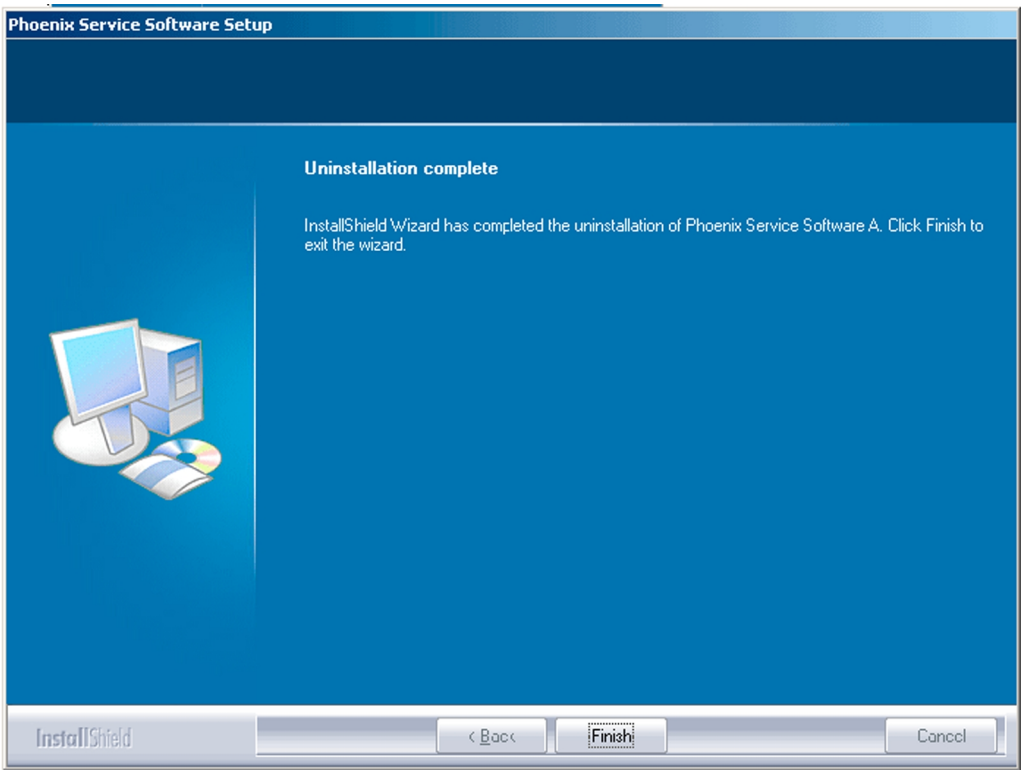

Figure 17 Finish uninstallation

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If the operating system requires rebooting, InstallShield Wizard will notify you. Select **Yes...** to reboot the PC immediately and **No...** to reboot the PC manually afterwards.

Repairing *Phoenix* installation

Context

If you experience any problems with the service software or suspect that files have been lost, use the repair function before completely reinstalling *Phoenix*.

Note: The original installation package (for example, *phoenix_service_sw_a15_2004_24_7_55.exe*) must be found on your PC when you run the repair setup.

Steps

1. Open **Windows Control Panel→Add/Remove Programs** .
2. Choose **Phoenix Service Software→Change/Remove** .
3. In the following view, select **Repair**.

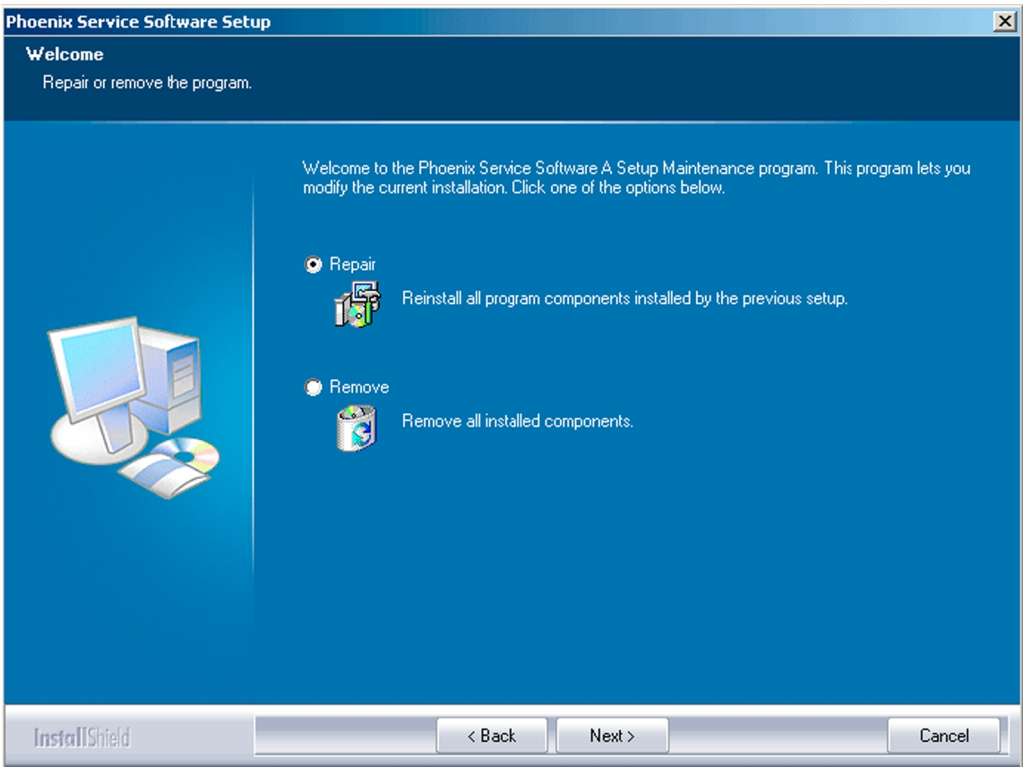

Figure 18 Repair program

Phoenix reinstalls components and registers them.

The procedure is the same as when updating *Phoenix*.

4. To complete the repair, click **Finish**.

Phone data package overview

Each product has its own data package (DP). The product data package contains all product-specific data files to make the Phoenix service software and tools usable with a certain phone model.

The phone data package contains the following:

- Product software binary files

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- Files for type label printing
- Validation file for the fault log repair data reporting system
- All product-specific configuration files for Phoenix software components

Data files are stored in **C:\Program Files\Nokia\Phoenix** (default).

Installing phone data package

Before you begin

- A phone-specific data package contains all data required for the *Phoenix* service software and service tools to be used with a certain phone model.
- Check that a dongle is attached to the parallel port of your computer.
- Install *Phoenix* service software.
- Download the installation package (for example, *XX-XX_dp_EA_v_1_0.exe*) to your computer (for example, in C:\TEMP).
- Close all other programs.

(XX-XX = type designator of the product)

If you already have *Phoenix* installed on your computer, you will need to update it when a new version is released.

> **Note:** Often *Phoenix* and the phone-specific data package come in pairs, meaning that a certain version of *Phoenix* can only be used with a certain version of a data package. Always use the latest available versions of both. Instructions can be found in phone-specific Technical Bulletins and *readme.txt* files of data packages.

Steps

1. To start the installation, run the application file (for example, *XX-XX_dp_EA_ v_1_0.exe*),

   Wait for the installation files to be extracted.

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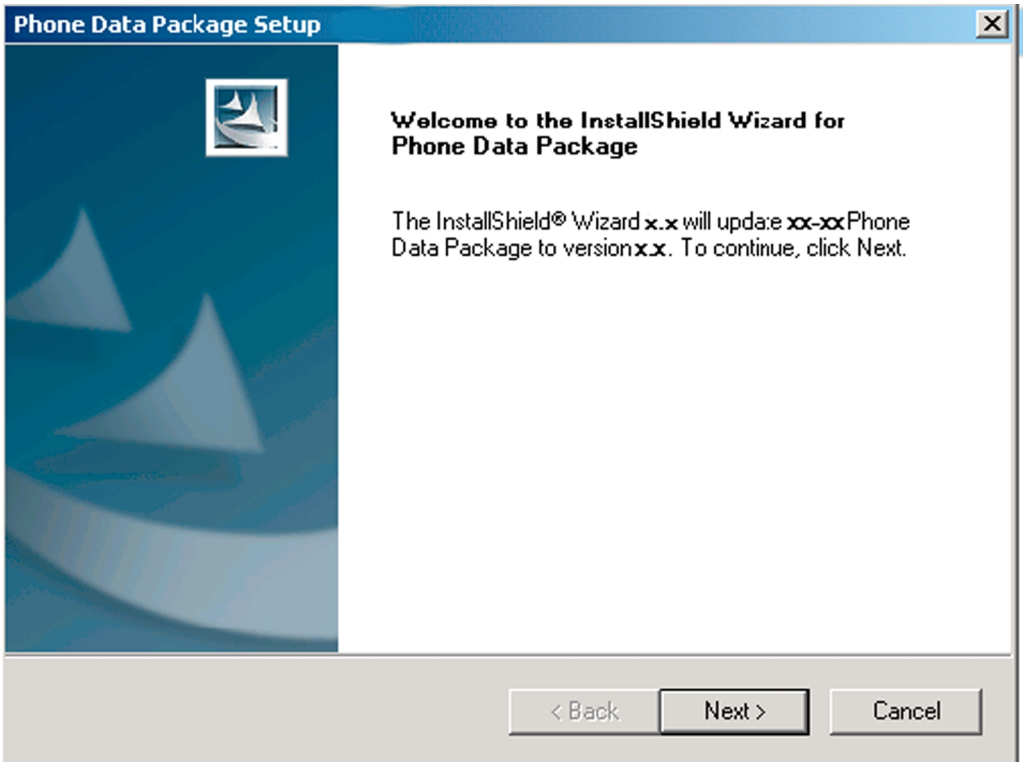
2. Click **Next**.



3. In the following view you can see the contents of the data package. Read the text carefully. There is information about the *Phoenix* version required with this data package.

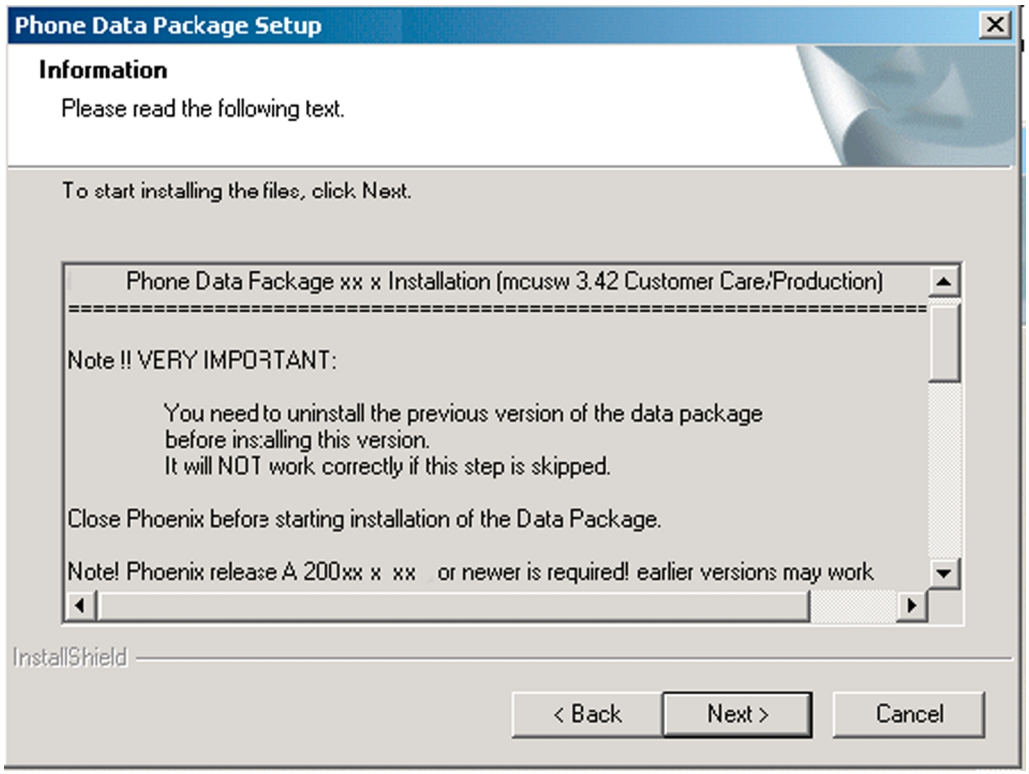


Figure 19 Data package setup information

4. To continue, click **Next**.

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5. Choose the destination folder, and click **Next** to continue.

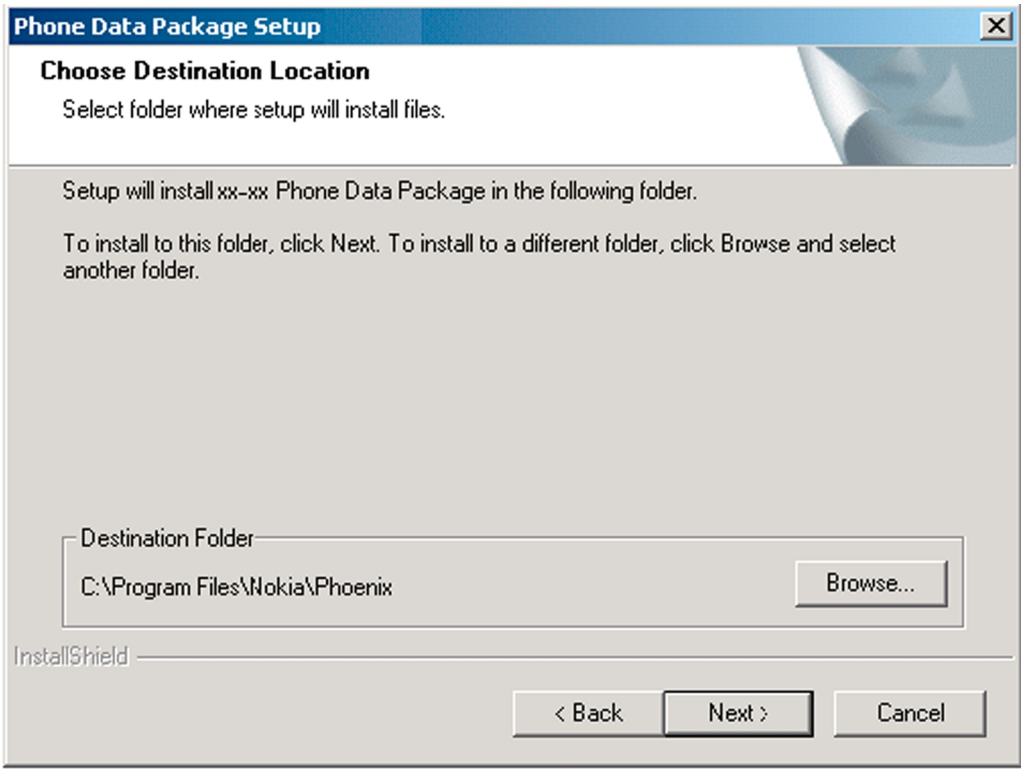
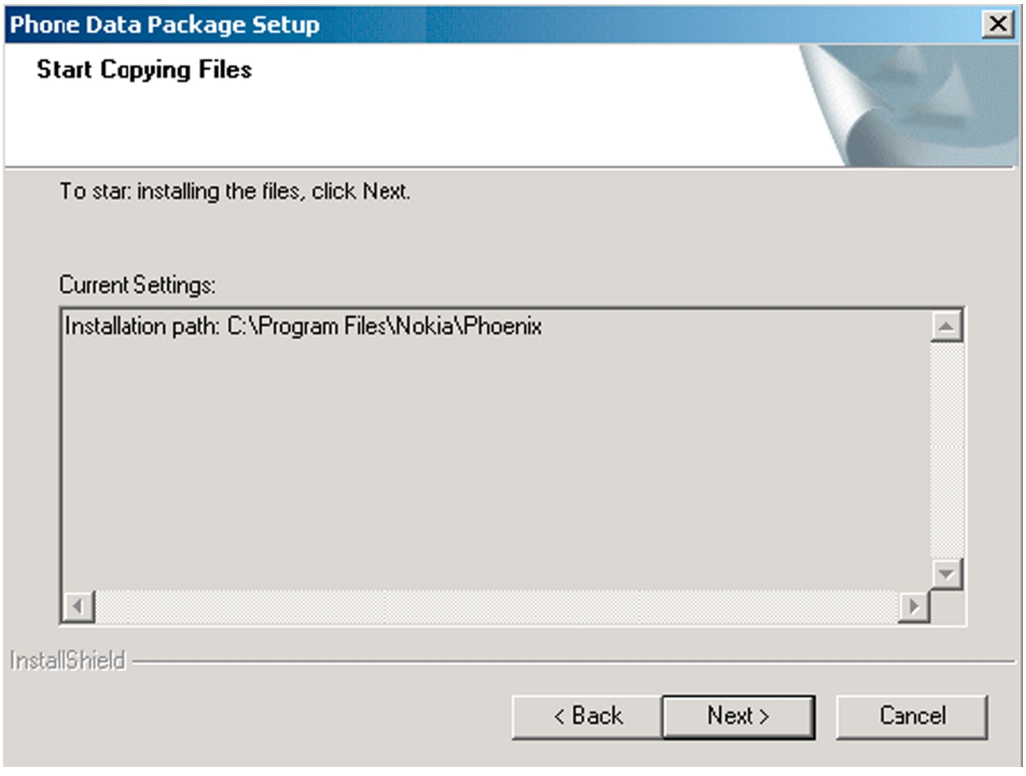


Figure 20 Data package destination folder

The InstallShield Wizard checks where *Phoenix* is installed, and the directory is shown.

6. To start copying the files, click **Next**.



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Phone model specific files are installed. Please wait.

7. To complete the installation, click **Finish**.

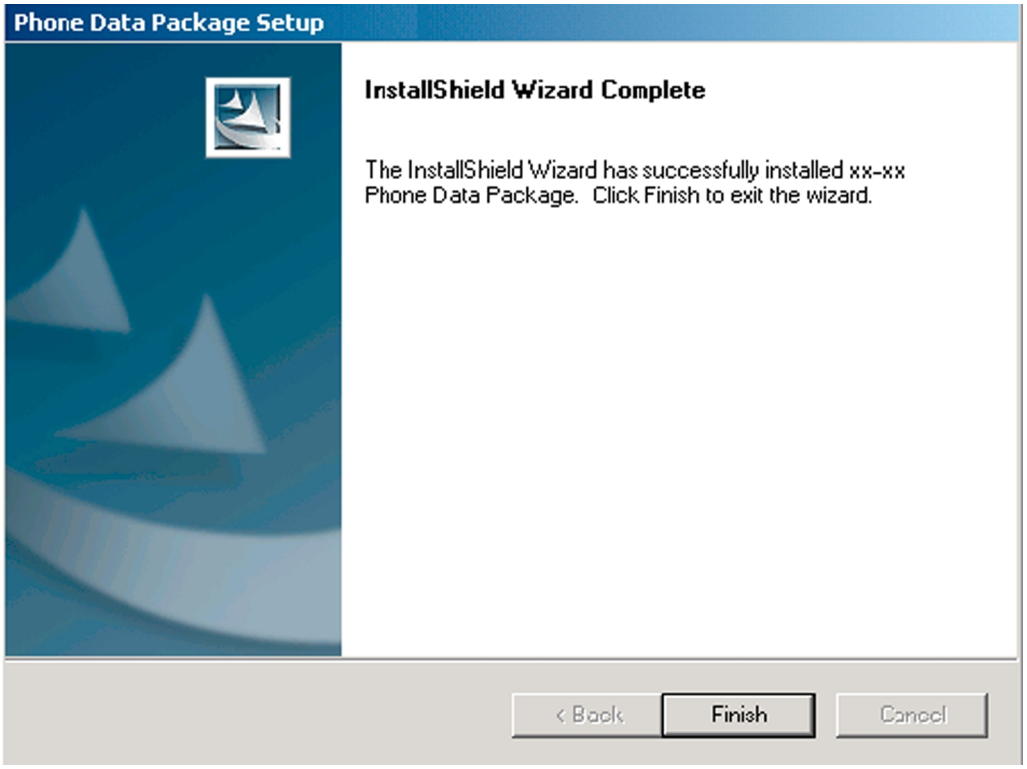

Figure 21 InstallShield Wizard Complete

Next action

Phoenix can be used for flashing phones and printing type labels after:

- Configuring users
- Managing connections

FPS-10 can be used after updating their flash update package files.

Uninstalling phone data package

Context

There is no need to uninstall an older version of a data package, unless instructions to do so are given in the *readme.txt* file of the data package and bulletins related to the release.

Please read all related documents carefully.

Steps

1. Locate the data package installation file (e.g. *XX-XX_dp_EA_v_1_0.exe*) from your computer.
2. To start the uninstallation procedure, double-click the data package installation file.

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3. To uninstall the data package, click **OK** or to interrupt the uninstallation, click **Cancel**.

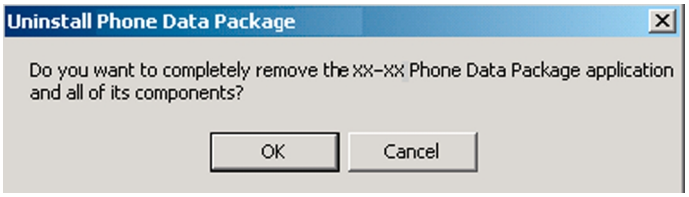

Figure 22 Uninstalling phone data package

4. When the data package is uninstalled, click **Finish**.

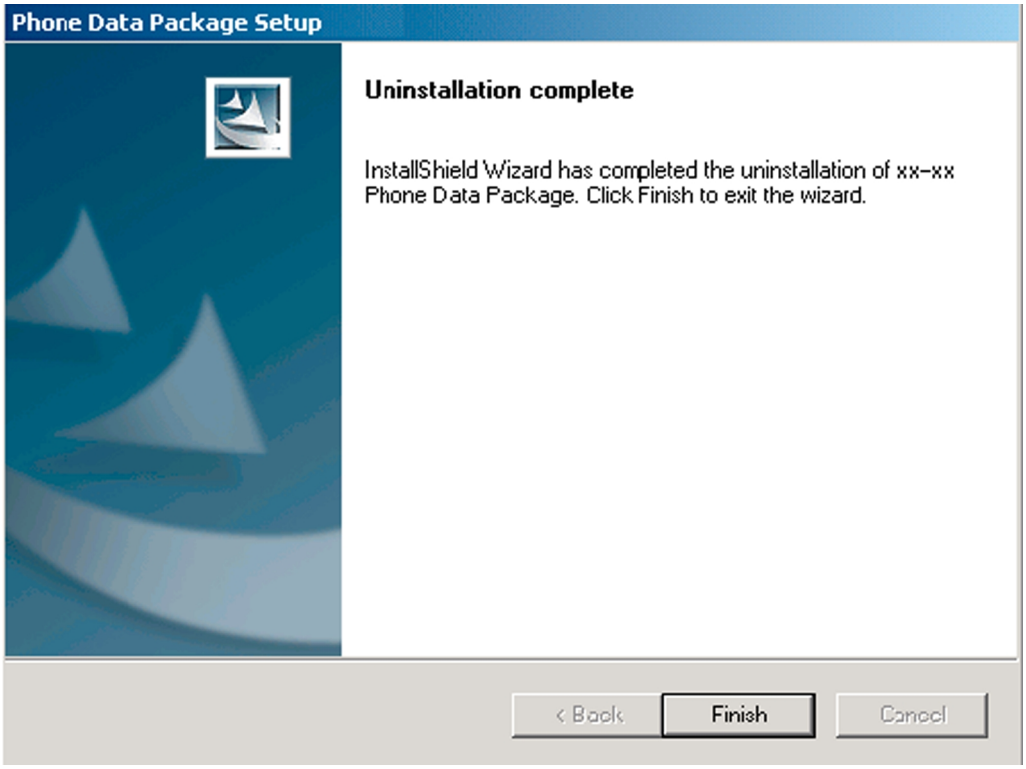

Figure 23 Finishing data package uninstallation

Alternative steps

- You can also uninstall the data package manually from **Control Panel→Add/Remove Programs→xx-xx* Phone Data Package** . (*= type designator of the phone).

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Configuring users in *Phoenix*

Steps

1. Start *Phoenix* service software, and log in.

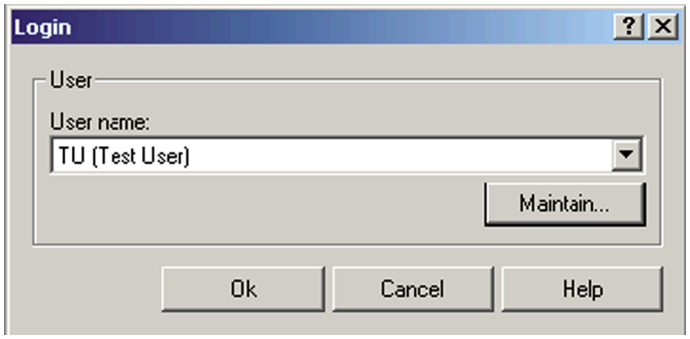

Figure 24 Phoenix login

   If the user ID is already configured, select s/he from the *User name* drop-down list, and click **OK**.
2. To add a new user, or to edit existing ones, click **Maintain**.
3. To add a new user, click **New**.
4. Type in the name and initials of the user, and click **OK**.
   The user is added to the user name list.
5. Select the desired user from the *User name* drop-down list, and click **OK**.

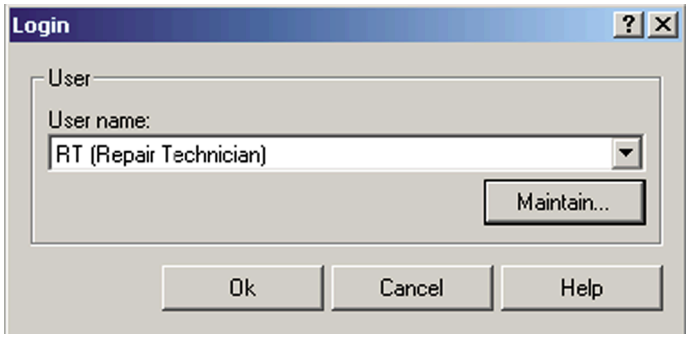

Figure 25 New user configured

Managing connections in *Phoenix*

Context

With the **Manage Connections** feature you can edit and delete existing connections or create new ones.

> **Note:** After choosing the desired connection, and connecting the phone to a PC for the first time, allow the PC to install the USB device drivers first. Please note that this may take some time to complete.
>
> If there are problems after the driver installation, check that the USB connection is active from the **Windows Control Panel**. If the problem persists, contact the local PC support.

Steps

1. Start *Phoenix*, and log in.
2. Choose **File→Manage Connections...** .

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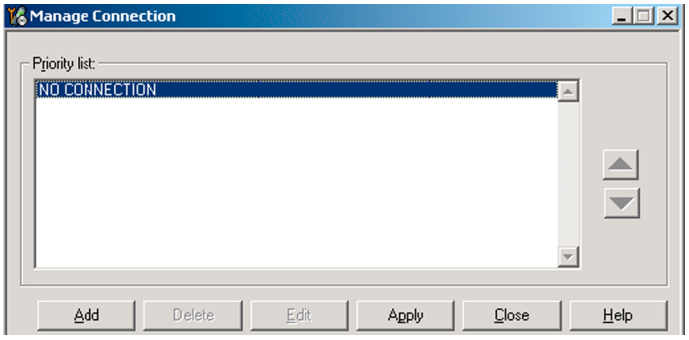
3. To add a new connection, click **Add**.



4. Select **Manual** mode, and click **Next** to continue.

   If you want to create the connection using the Connection Wizard, connect the tools and a phone to your PC. The wizard will automatically try to configure the correct connection.

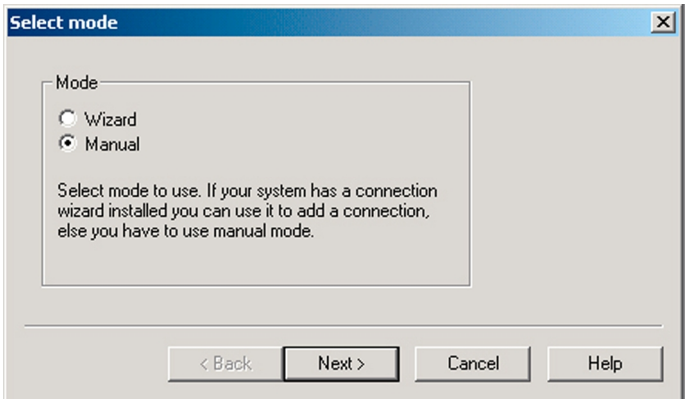


Figure 26 Select mode: Manual

i For an FPS-10 flash prommer with a **USB Connection**, choose the following connection settings:
   - Media: **FPS-10 USB**
   - DEVICE_INDEX: **0**
   - SERIAL_NUM: See Serial No from the label attached to the bottom of FPS-10
   - ACTIVE_MEDIA: **USB**

ii For an FPS-10 flash prommer with a **LAN connection**, choose the following connection settings:
   - Media: **FPS-10 TCP/IP**
   - NET_SERV_NAME: Click **Scan...**. Choose your own FPS-10 device based on the correct MAC address. See Serial No from the label attached to the bottom of your FPS-10.
   - PORT_NUM: Use the default value, and click **Next**.
   - PROTOCOL_FAMILY: Use the default value, and click **Next**.
   - SOCKET TYPE: Use the default value, and click **Next**.
   - TX_BUFFER_SIZE: Use the default value, and click **Next**.
   - RX_BUFFER_SIZE: Use the default value, and click **Next**.

iii For an FPS-8 flash prommer, choose the following connection settings:
   - Media: FPS-8
   - PORT_NUM: COM Port where FPS-8 is connected
   - COMBOX_DEF_MEDIA: **FBUS**

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iv For a plain **USB connection**, choose the following connection settings:

Note: First connect the DKU-2 USB cable between the PC USB port and phone.

- Media: USB

5. To complete the configuration, click **Finish**.
6. Click the connection you want to activate. Use the up/down arrows located on the right hand side to move it on top of the list, then click **Apply**.

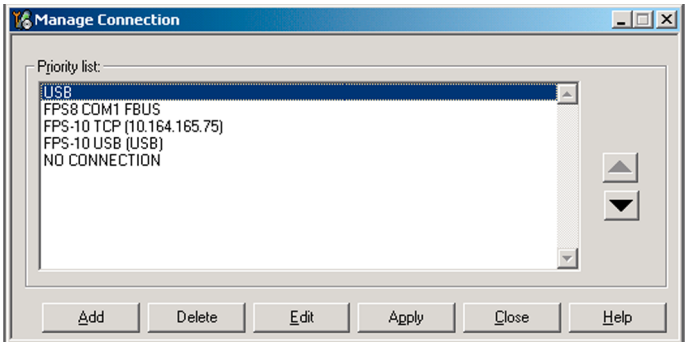

Figure 27 Connections list

The connection is activated, and it can be used after closing the *Manage Connection* window.

The connection information is shown at the right hand bottom corner of the screen.

Figure 28 Connection information

7. To use the connection, connect the phone to your PC with correct service tools. Make sure the phone is switched on, and then choose **File→Scan Product** .

Results

The product support module information appears in the status bar:

Figure 29 Product support module information (example from RM-1)

Installing flash support files for FPS-10

Before you begin

Note: You need to install flash support files for FPS-10 only, if you don't have the latest Phoenix available or the flash support files have changed after the latest Phoenix release.

- Flash support files are installed automatically, when you install Phoenix. Use Phoenix packages later than June 2005.
- Normally it is enough to install Phoenix and the phone-specific data package because the Phoenix installation always includes the latest flash update package files for FPS-10.
- A separate installation package for flash support files is available, and the files can be updated according to this instruction, if updates appear between new Phoenix / data package releases

Context

If you are not using a separate installation package, you can skip this section and continue with "Updating FPS-10 flash prommer software" (page 3–22) after installing a new phone data package.

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Steps

1. To begin installation, double- click *flash_update_x_yy.exe* .

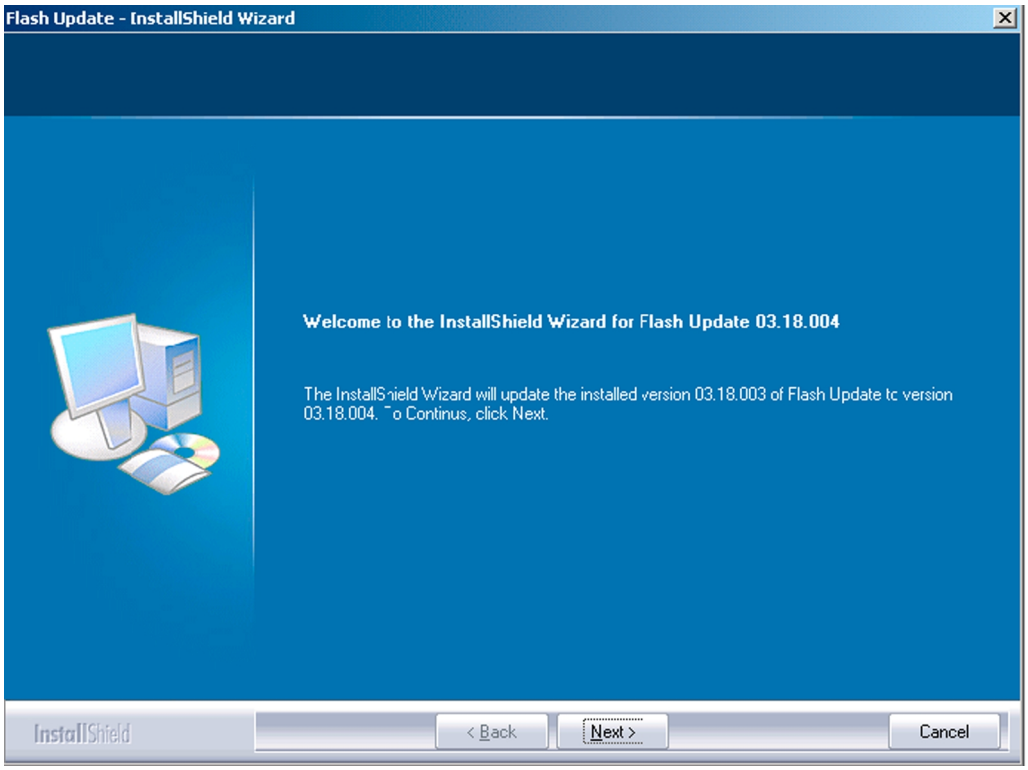

Figure 30 Flash update welcome dialog

If the same version of Flash Update package already exists, and you want to reinstall it, the previous package is first uninstalled. Restart installation again after that.

2. If you try to downgrade the existing version to older ones, the setup will be aborted. If you really want to downgrade, uninstall newer files manually from **Control Panel** and then rerun the installation again.

Figure 31 Flash installation interrupted

If an older version exists on your PC and it needs to be updated, click **Next** to continue installation.

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3. It is highly recommended to install the files to the default destination folder *C:|Program Files|Nokia |Phoenix*. Click **Next** to continue.

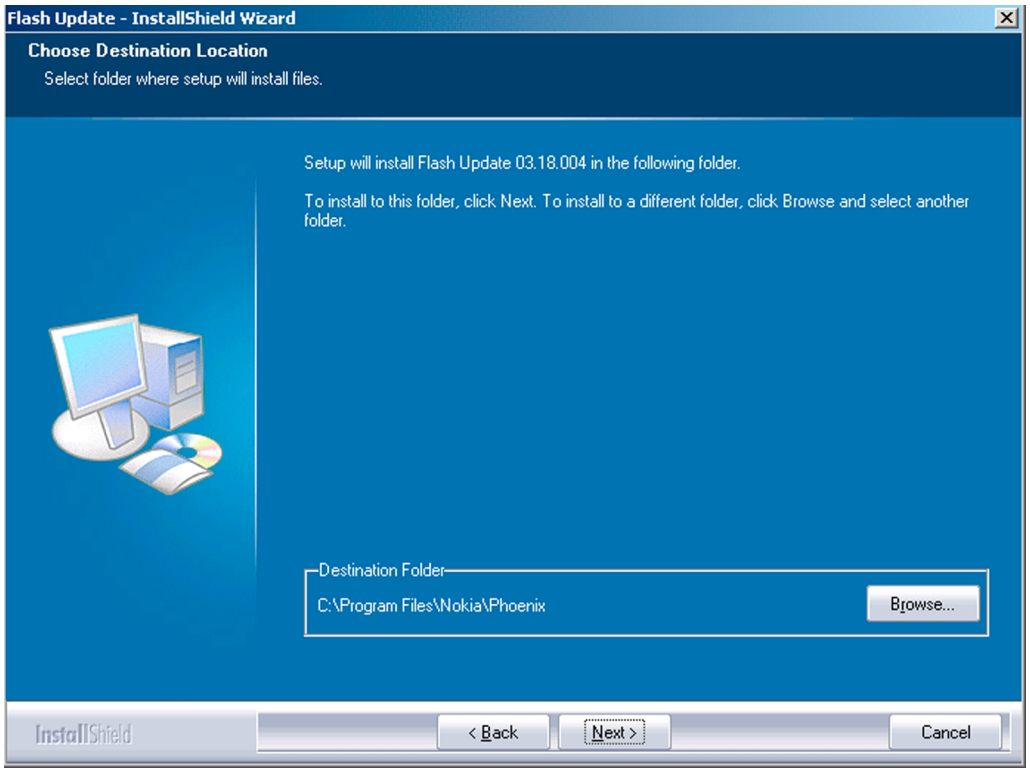

Figure 32 Flash destination folder

When installing the flash update files for the first time you may choose another location by selecting **Browse**. However, this is not recommended.

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4. To complete the installation procedure, click **Finish** .

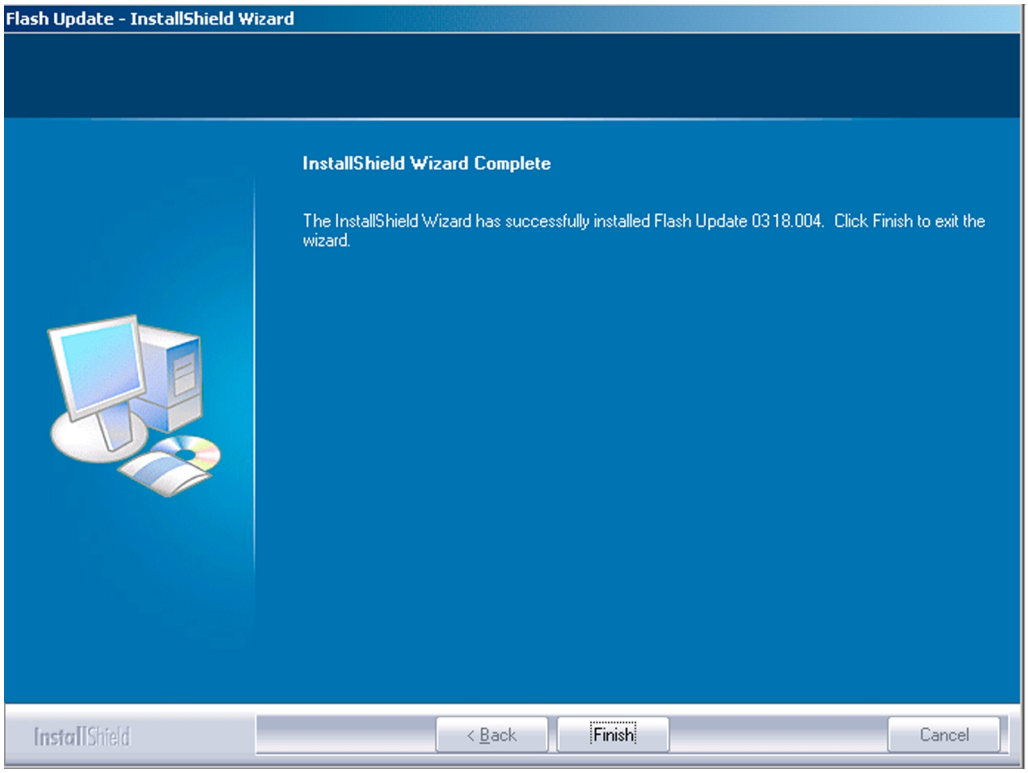

Figure 33 Finish flash update

Next action

FPS-10 flash prommers must be updated using Phoenix!

Updating FPS-10 flash prommer software

Steps

1. Start *Phoenix Service Software* and log in, manage connection correctly for your flash prommer.
2. Choose **Flashing→Prommer maintenance** .

Figure 34 Choosing Prommer maintenance

3. When the new flash update package is installed to the computer you will be asked to update the files to your Prommer. To update the files, click **Yes**. Click **OK** if the computer informs you about an unsafe removal of the device.
4. Alternatively you can update the FPS-10 flash prommer software by clicking the **Update** button.

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5. Wait until you are notified that update has been successful; the procedure will take a couple of minutes. Click **OK** to close the *Update Done* window.

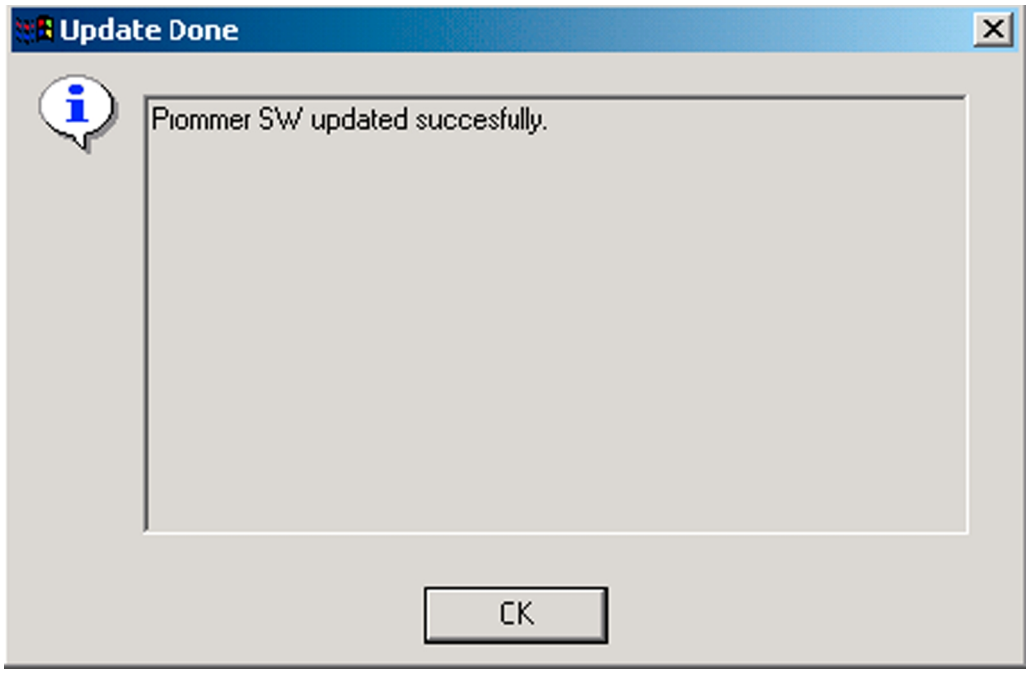

Figure 35 Prommer SW update finished

6. If you are using the FPS-10 flash prommer, check that it is detected from the progress info. Check also the status leds in the FPS-10. The MODE2 led (green), VBAT and POWER leds (red) should be lit. If you are using LAN connection, the LAN led (yellow) should be blinking.
7. Check that your FPS-10 flash prommer has enough memory. Flashing the SU-18 with FPS-10 needs at least 128 MB of SRAM memory in the prommer.

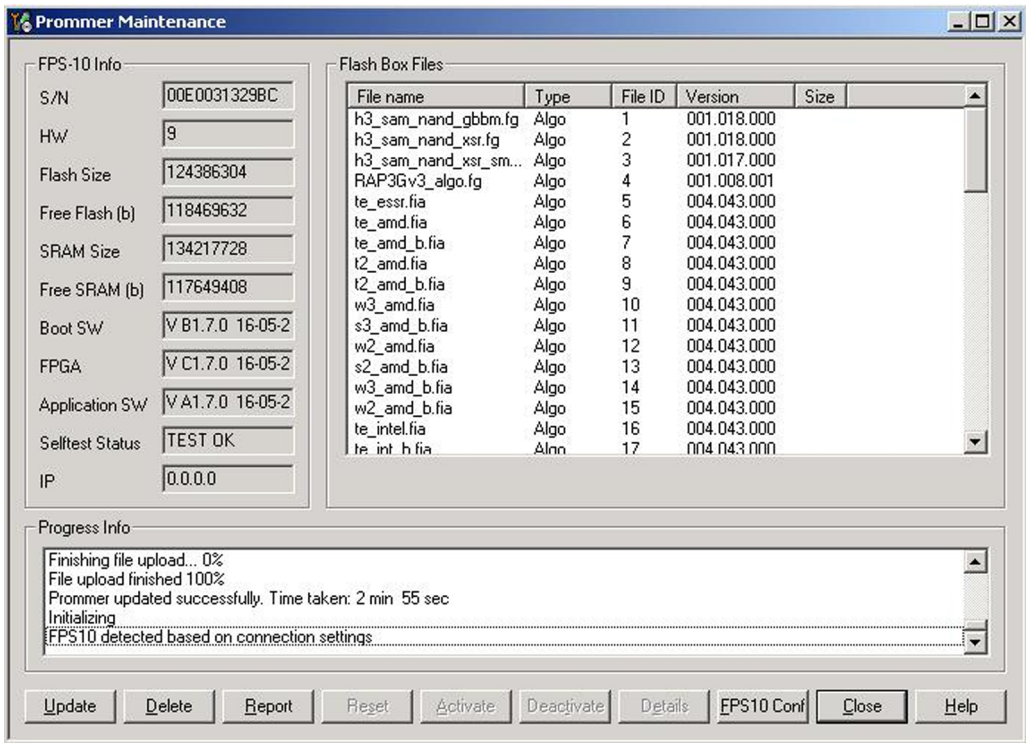

Figure 36 Prommer maintenance window

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Alternative steps

- You can update FPS-10 SW by clicking the **Update** button and selecting the appropriate fpsxupd.ini file in *C:|Program Files|Nokia|Phoenix|Flash*.

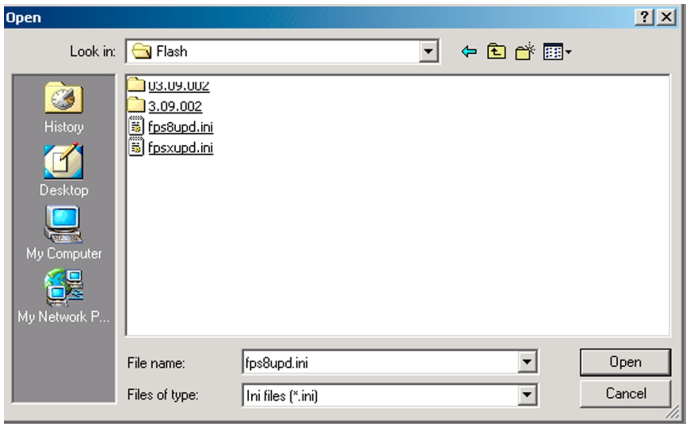

Figure 37 Flash directory window

- All files can be loaded separately to the prommer used. To do this, click the right mouse button in the *Flash box files* window and select the file type to be loaded.

  More information can be found in Phoenix **Help**.

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4 — Service Tools and Service Concepts

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Service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-91; RM-92, refer to various concepts.

	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		
	CA-35S	Power cable	
	CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		

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CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

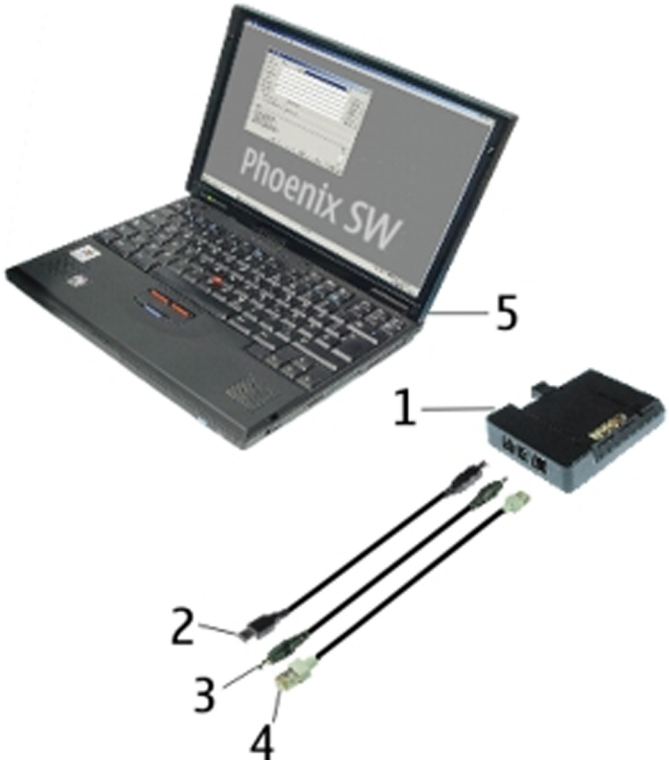
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.
2 Connect CU-4 to your PC with a USB cable.
3 Connect supply voltage (12 V)
4 Connect an FBUS cable (if necessary).
5 Start Phoenix service software.



Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

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<table>
<tr><td rowspan="2"> </td><td>DKU-2</td><td>USB connectivity cable</td><td></td></tr>
<tr><td colspan="3">USB to system connector cable.</td></tr>
<tr><td rowspan="2"> </td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:
• PC
• Control unit
• Flash adapter
• Smart card
FPS-10 flash prommer features:
• Flash functionality for BB5 and DCT-4 terminals
• Smart Card reader for SX-2 or SX-4
• USB traffic forwarding
• USB to FBUS/Flashbus conversion
• LAN to FBUS/Flashbus and USB conversion
• Vusb output switchable by PC command
FPS-10 sales package includes:
• FPS-10 prommer
• Power Supply with 5 country specific cords
• USB cable</td></tr>
</table>

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FS-13	Flash adapter	

Flash adapter FS-13 is used for phone testing and flashing. FS-13 is used with the generic flash adapter base SS-60/62 and control unit CU-4 or interface adapter SS-46.

When flashing or system testing the phone, the adapter is attached to replace the phone own battery.

All functions (as well as the calibration voltages, current and the protections for over voltages, over current and voltage polarity), are performed by CU-4.

Flash adapter FS-13 main features:

- VBATT supply interface
- USB / FBUS multiplexed interface to the phone
- Supply voltage for light source

MJ-66	Module jig	

MJ-66 is meant for component level troubleshooting.

The jig includes an RF interface for GSM, WCDMA, Bluetooth and NCW (WLAN). In addition, it has the following features:

- Provides mechanical interface with the engine module
- Provides galvanic connection to test pads
- Multiplexing between USB and FBUS media, controlled by Vusb
- UI test interface
- MMC interface
- Audio components: IHF, MIC, earpiece
- Connector for control unit
- Access for system connector

Note: In the picture, two RF probes are shown. These are not part of the MJ-66 sales package and must be ordered separately.

- **Table 7 Attenuation values**

Band	Attenuation
GSM850	0.25
GSM900	0.25
GSM1800	0.4
GSM1900	0.45
WCDMA1900	0.45
WCDMA2100	0.5

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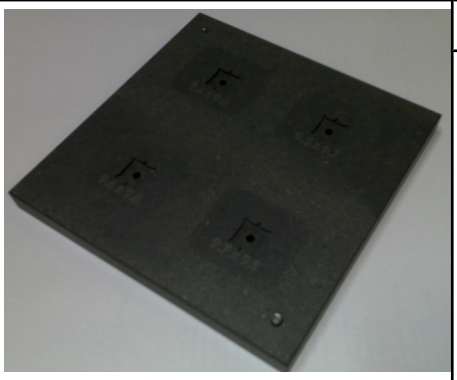
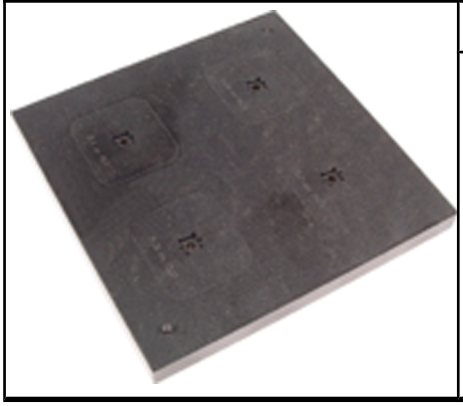
PCS-1	Power cable	
The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled operating voltage.		

PKD-1	SW security device	
SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Without the device, it is not possible to use the service software. Printer or any such device can be connected to the PC through the device if needed.		



RJ-103	Rework jig for WLAN	
RJ-103 is a rework jig used with rework stencil ST-36.		

RJ-114	Rework jig	
RJ-114 is a rework jig used with ST-41.		



RJ-57	Rework jig	
RJ-57 is a rework jig used with ST-22.		

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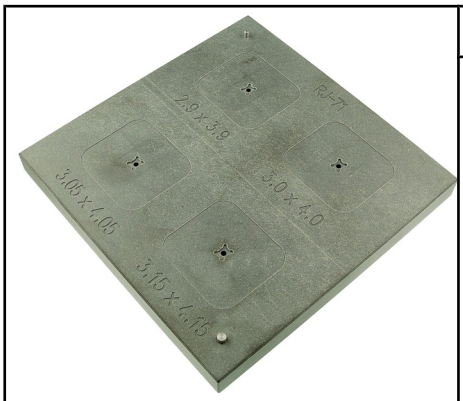
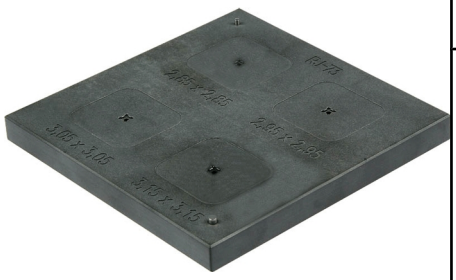
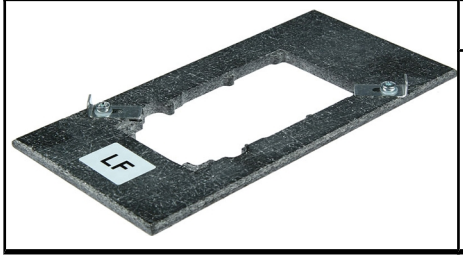
	RJ-71	Rework jig	
	RJ-71 is a rework jig used with ST-26 rework stencil.		
	RJ-73	Rework jig	
	RJ-75	Soldering jig	
	RJ-75 is a soldering jig used for soldering and as a rework jig for the engine module.		

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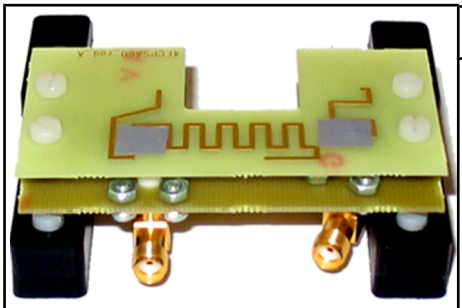

SA-95	RF coupler	

SA-95 is an RF coupler for WCDMA and GSM RF testing. It is used together with the product-specific flash adapter.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-95:

- **RF Coupler Loss**

WCDMA Coupler	Channel	Coupler Loss
		dB
WCDMA 1900 Band II TX	9262	14.8
	9400	13.0
	9538	12.5
WCDMA 1900 Band II RX	9662	14.8
	9800	13.0
	9938	12.5
WCDMA 2100 Band I TX	9612	16.3
	9750	16.4
	9887	15.7
WCDMA 2100 Band I Rx	10562	16.3
	10700	16.4
	10837	15.7
GSM Coupler	Channel	Coupler Loss
		dB
GSM 850 Tx\Rx	128	5.1
	190	4.7
	251	4.7
GSM 900 Tx\Rx	975	6.4
	38	8.0
	124	10.0
GSM 1800 Tx\Rx	512	8.0
	700	11.5
	885	11.3
GSM 1900 Tx\Rx	512	9.5
	661	9.3
	810	9.6

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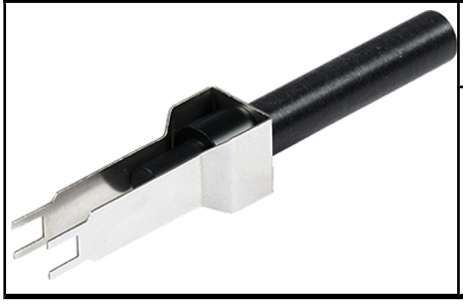
	SB-6	Bluetooth tester	
	The SB-6 test box is a generic device to perform Bluetooth bit error rate testing and doing cordless FBUS connection via Bluetooth.		
	SB-7	WLAN test box	
	WLAN test requires defined position for the device.		
	SPS-2	Soldering paste spreader	
	SRT-6	Opening tool	
	SS-45	Front camera removal tool	
	The front camera removal tool SS-45 is used to remove/attach the front camera module from/to the socket.		

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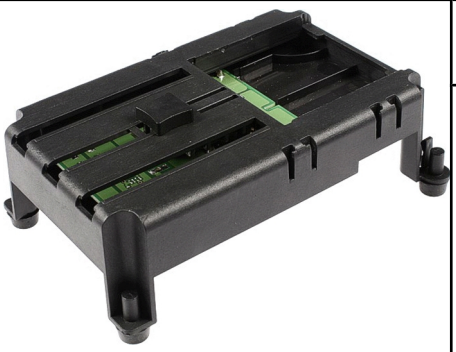
	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-10.		
	SS-51	Front camera removal tool	
	The front camera removal tool SS-51 is used to remove/attach a front camera module from/to the camera socket of the phone PWB.		
	SS-62	Generic flash adapter base for BB5	
	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using galvanic connector or coupler • multiplexing between USB and FBUS media, controlled by VUSB		
	SS-93	Opening tool	
	ST-20	Rework stencil	
	ST-20 is used with RJ-73 rework jig.		

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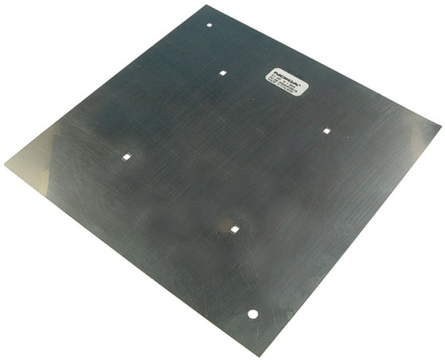
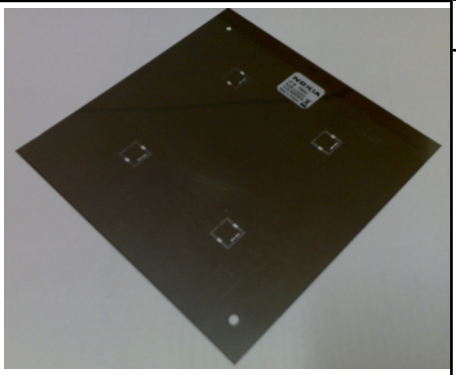
	ST-26	Rework stencil	
	ST-26 is a rework stencil used with rework jig RJ-71.		
	ST-36	Rework stencil	
	ST-36 is a rework stencil used with rework jig RJ-103.		
	ST-41	Rework stencil	
	ST-41 is a rework stencil used with rework jig RJ-114.		
	ST-44	Rework stencil	
	ST-44 is a rework stencil used with rework jig RJ-57.		
	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.		

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	XCS-1	Service cable	
	The XCS-1 service cable is used to connect FLS-4S to the POS flash adapter for supplying a controlled operating voltage and data connection.		
	XCS-4	Modular cable	
	XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		
	XRS-6	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector ca. 610mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WLAN: 0.6+-0.1dB		

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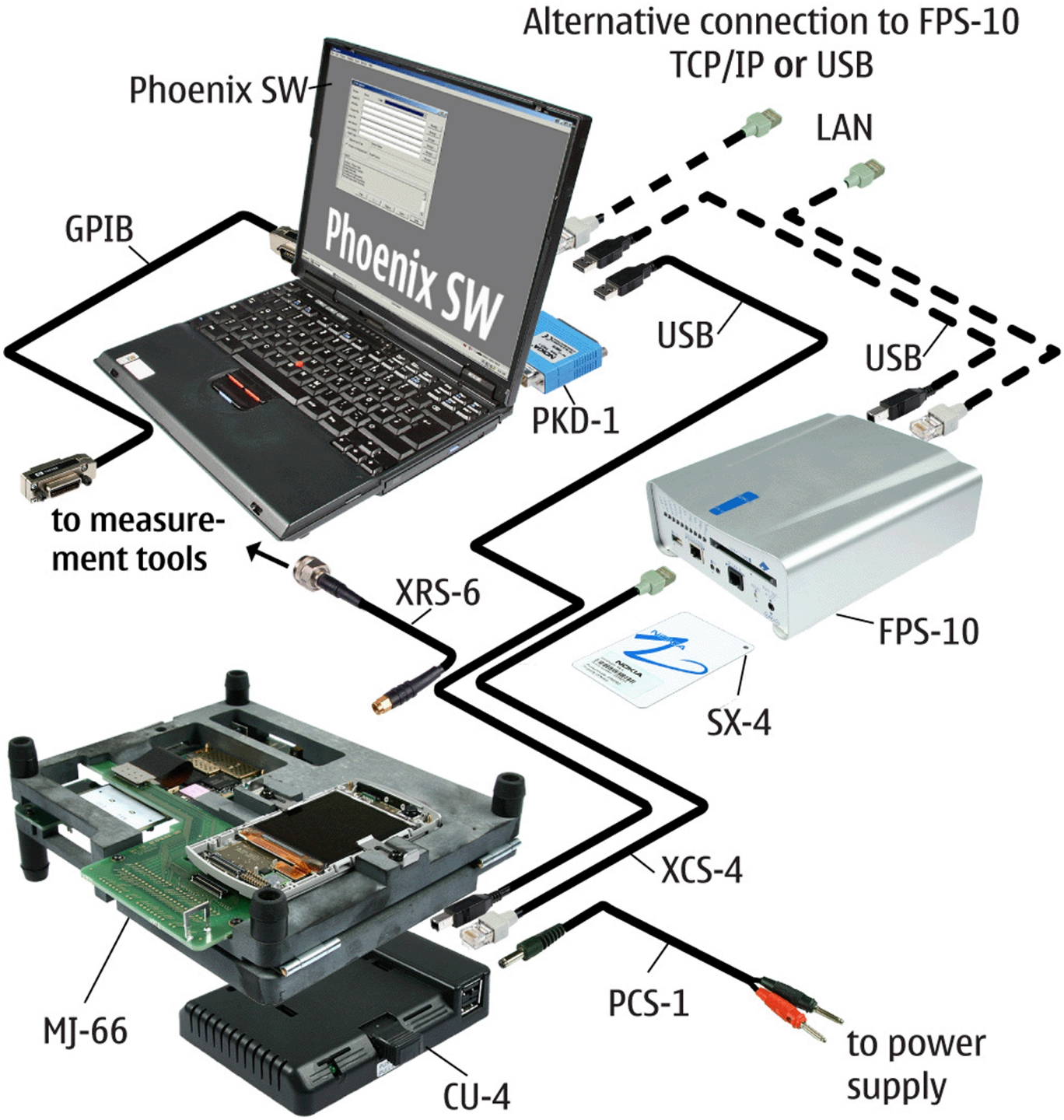
Service concepts

Flash concept with MJ-66, CU-4, FPS-10 and SX-4



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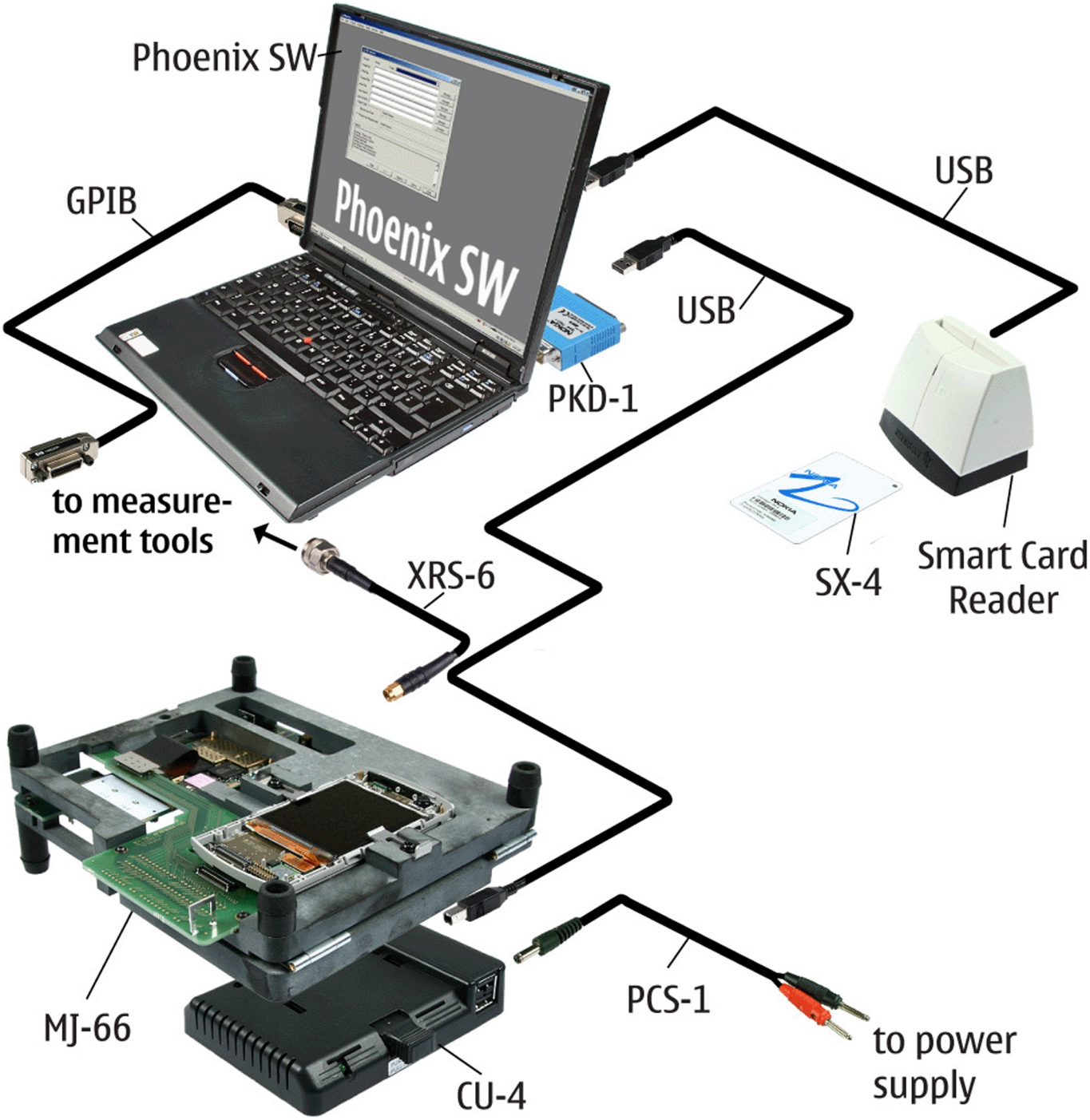
Flash concept with MJ-66, CU-4, smart card reader and SX-4



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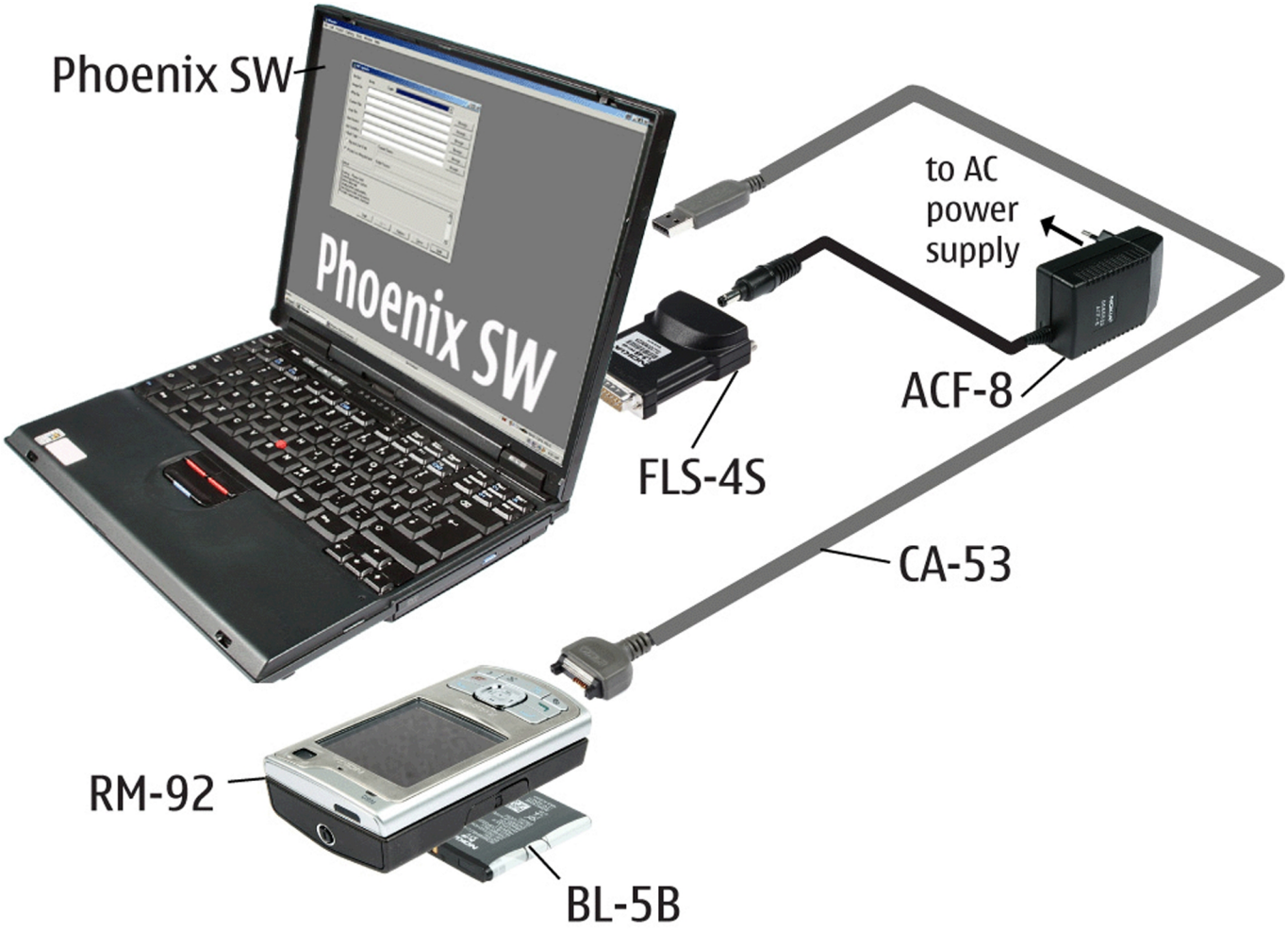
POS flash concept



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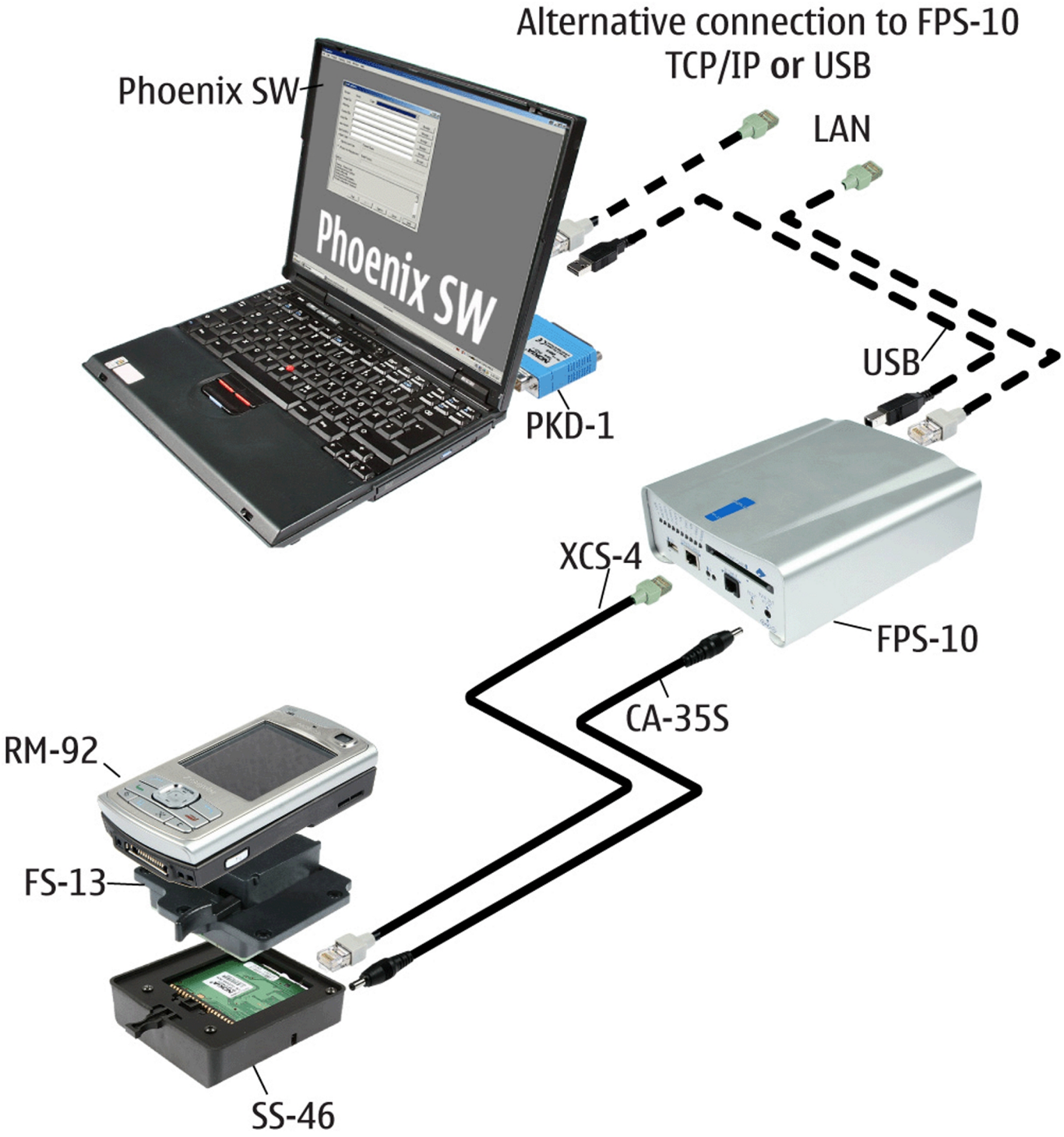
Flash concept with SS-46, FS-13 and FPS-10



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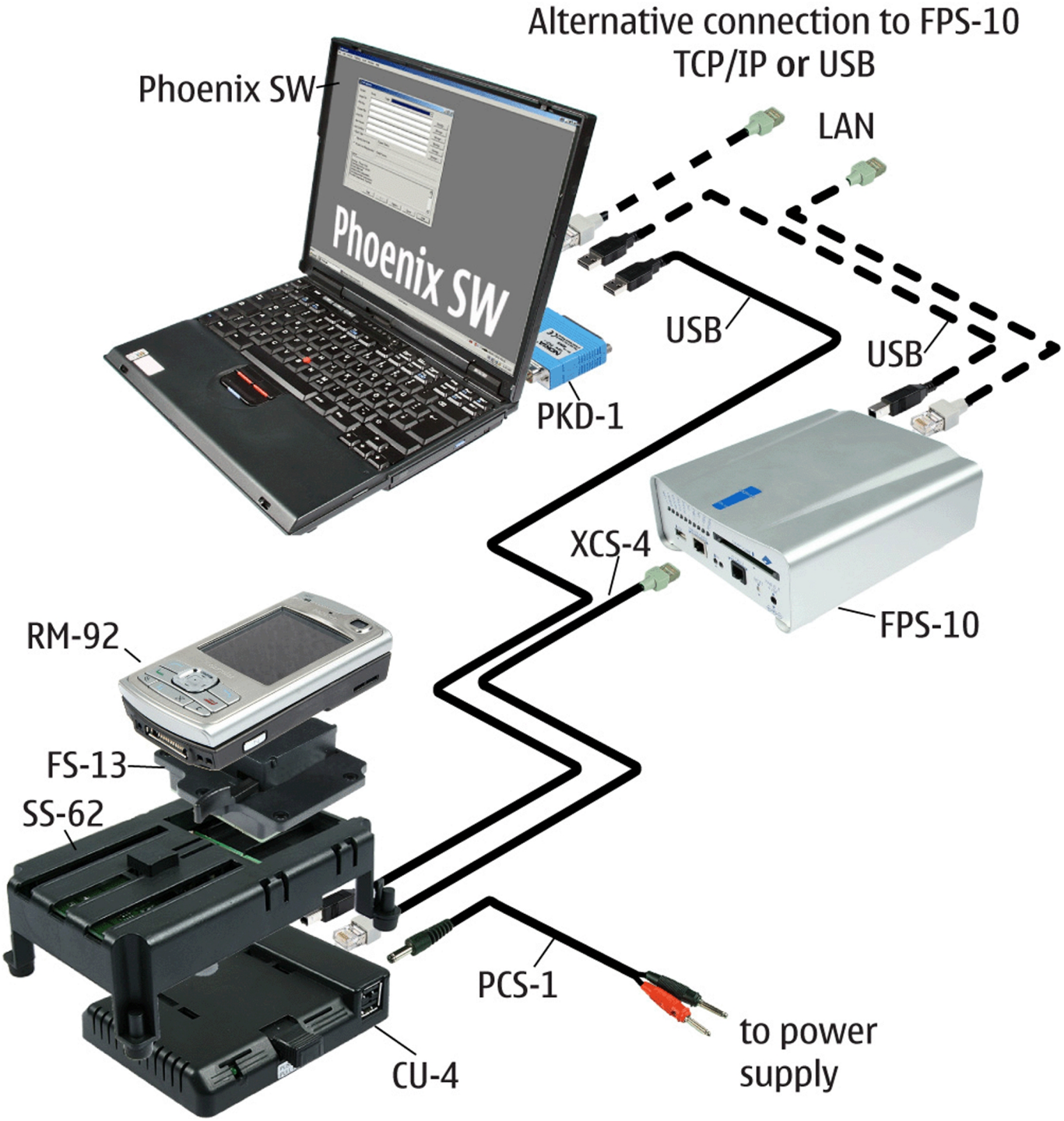
Flash concept with SS-62, FS-13, CU-4 and FPS-10



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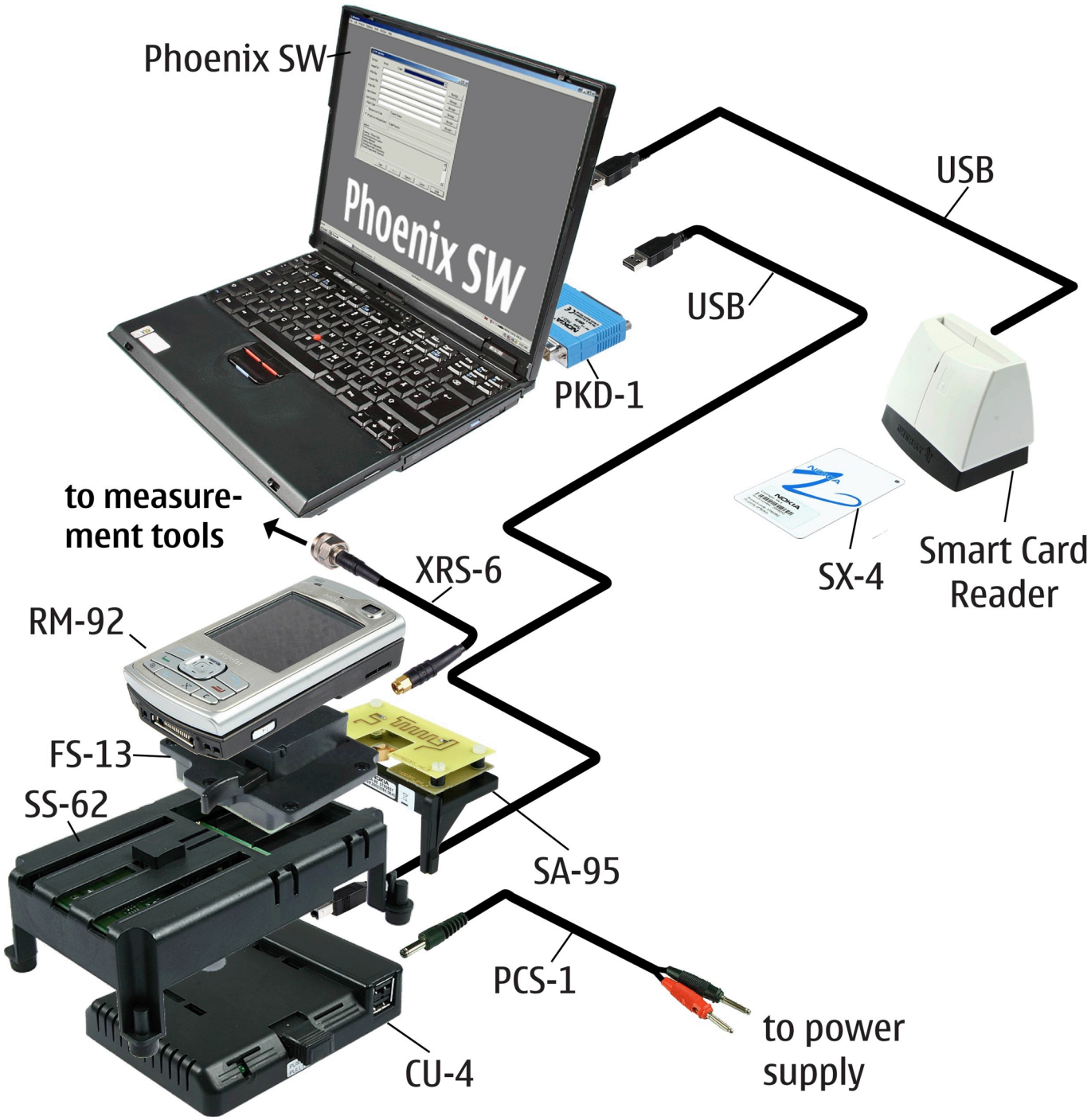
Flash concept with SS-62, FS-13, CU-4, smart card reader and SX-4



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5 — Disassembly/Reassembly Instructions

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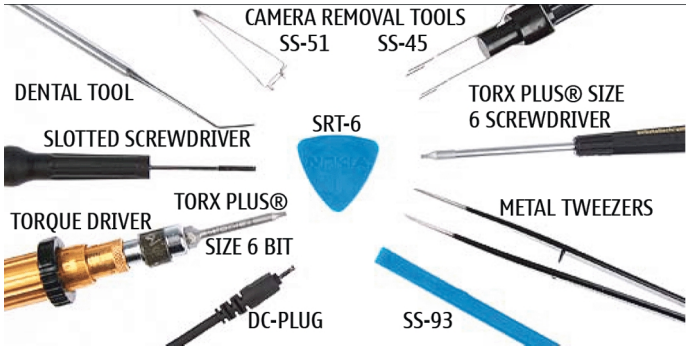
Disassembly / reassembly instructions

Before you begin

Needed tools for disassembly:



Note: Reassembly takes place in the reverse order.

Note the reassembly-specific instructions in steps **4, 10, 16, 17, 35, 39, 42, 43,** and **44**.

Steps

1. Protect the window with a film.

2. Also protect the camera window with a film.

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3. Open the C-COVER.

4. Unscrew the Torx Plus® size 6 SCREWS in the order shown. **For assembly, use the reverse order with a torque setting of 14Ncm.**

5. Place the SRT-6 between the A-COVER and the UI FRAME ASSY and unlock the first snap. Then follow the order shown in picture 6.

6. Unlock the four snaps with the SRT-6 in the shown direction.

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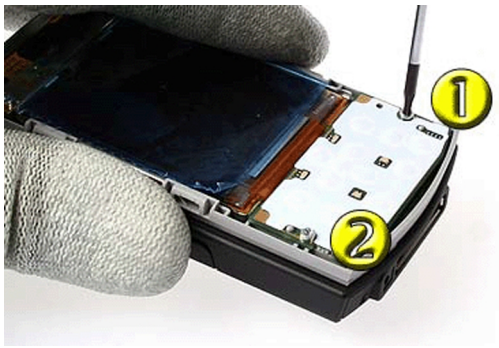
7. Remove the A-COVER.

8. Remove the KEYMAT S60 and protect the inner side of the A-COVER with a film.

9. Protect the LCD ASSY with a film.

10. Unscrew the Torx Plus® size 6 SCREWS in the order shown. **For assembly, use the reverse order with a torque setting of 14Ncm.**



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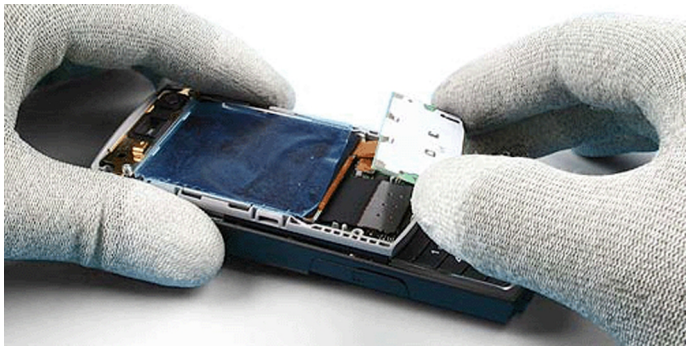
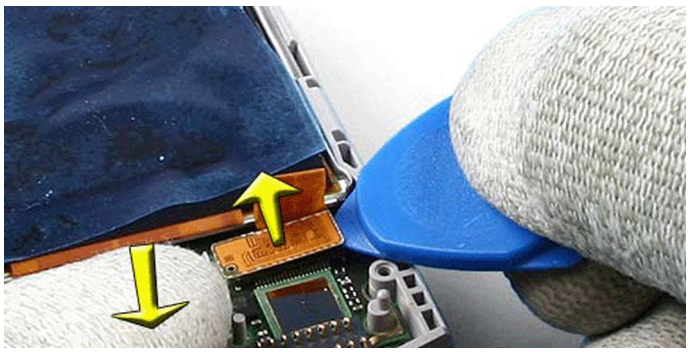
11. Remove the UI-KEYMAT PWB S60 ASSY.

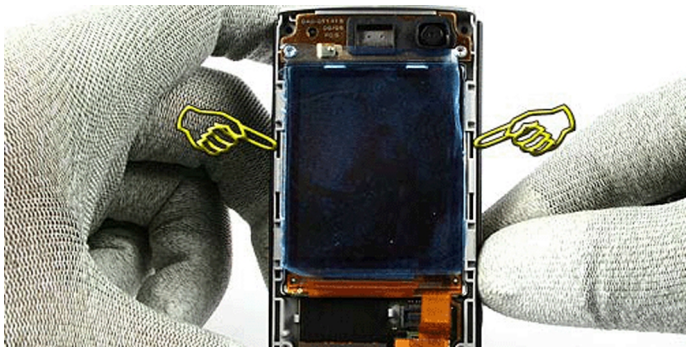


12. Hold the FLEXI CONNECTOR pressed while opening the LCD K2 connector.

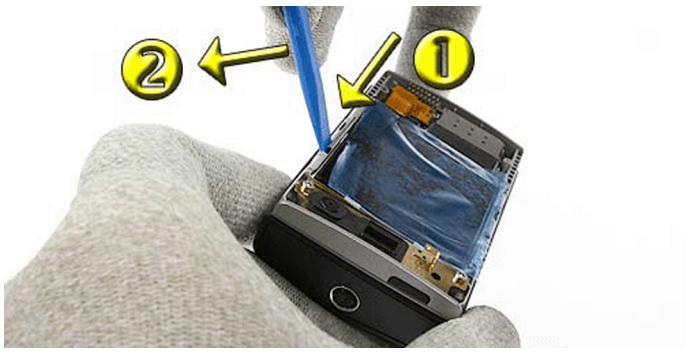
    Note: Do not over stress the FLEXI when disconnecting.



13. Unlock the LCD K2 from the UI FRAME ASSY with the SS-93.



14. Place the SS-93 between the LCD K2 and the UI FRAME ASSY and release the snaps on both sides.



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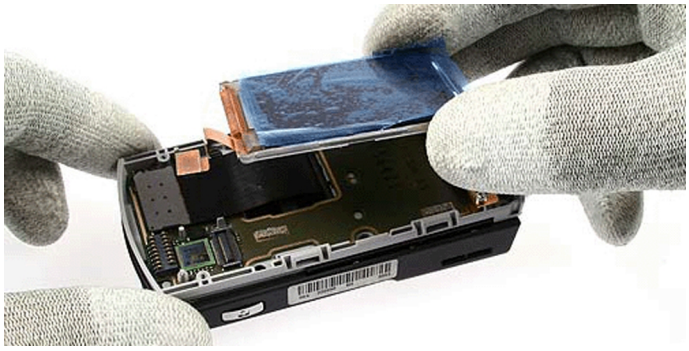
15. Now remove the LCD K2.



16. Unscrew the Torx Plus® size 6 SCREWS. **For assembly, tighten the screws with a torque setting of 14Ncm.**

17. Remove the UI SUPPORT.

    Note: When assembling the UI SUPPORT it is important to place it under the marked edge.

18. Push out the EARPIECE.

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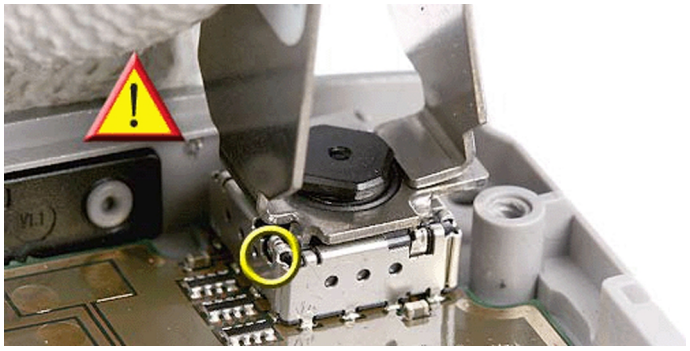
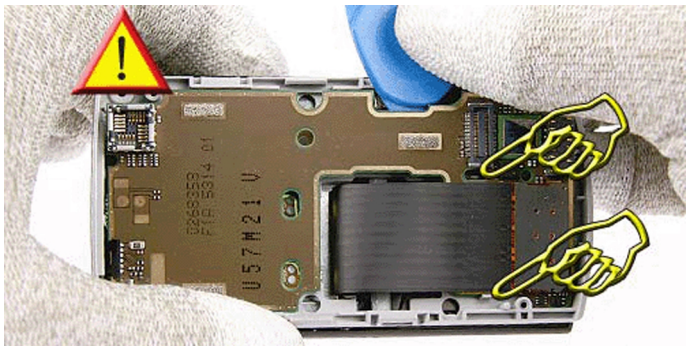
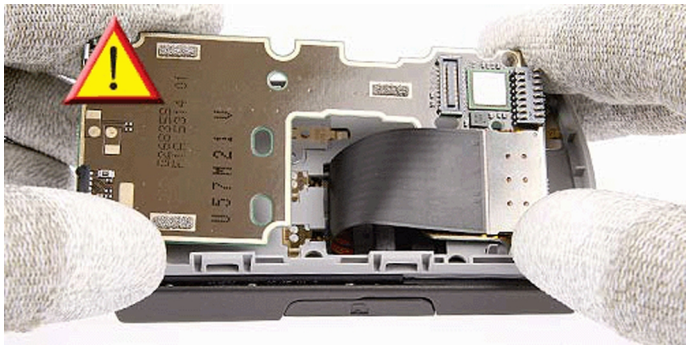
19. Unlock and remove the VGA CAMERA with the SS-51. Note the guide pin when re-assembling the CAMERA.



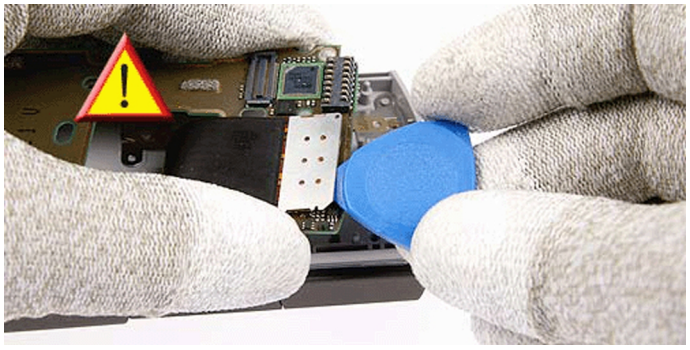
20. Lift up the 1MJ UI PWB ASSY with the SRT-6 carefully. Do not damage the two snaps on both sides of the FLEX I/CONN MODULE.



21. Gently, lift the UI PWB a bit.



22. Take special care when opening the FLEX I connector.



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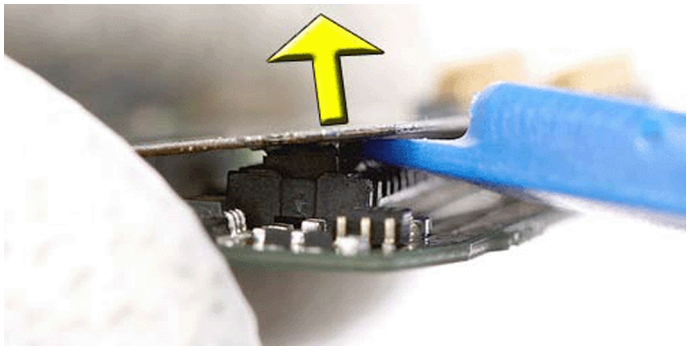
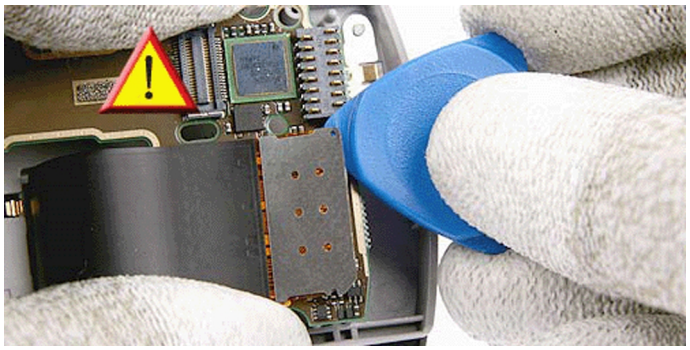
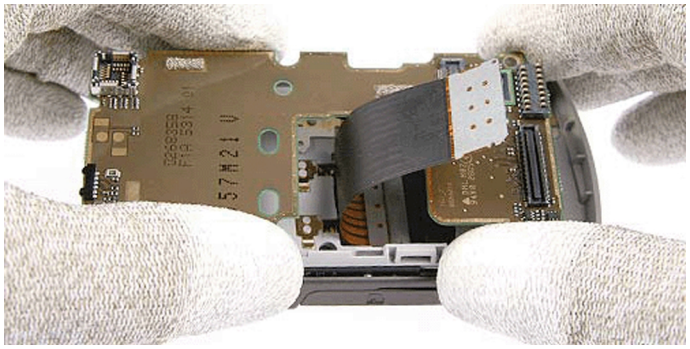
23. Place the SRT-6 exactly as shown and slide it gently along the edge of the connector.



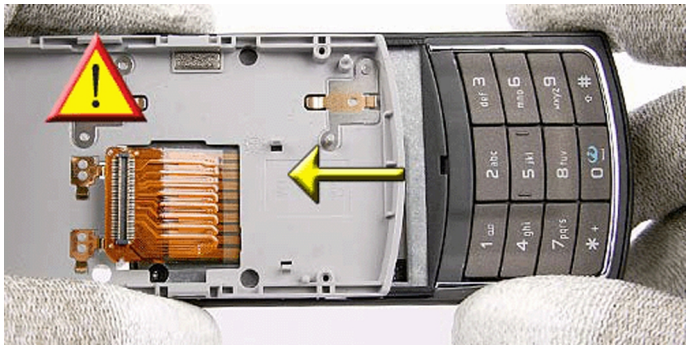
24. Lift the other side of the connector as shown. Avoid bending the spring contacts of the BOARD TO BOARD CONNECTOR.



25. Now, remove the UI PWB ASSY.



26. Open the UI FRAME ASSY a bit as shown. Do not separate the parts yet.



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27. First, start to unlock the first snap and then follow the shown order in picture 28.

28. To unlock the KEYMAT BEZEL use the SRT-6 to open the 5 snaps in the shown order and at the correct place.

29. To open the snaps 2-5 only stick in the SRT-6 between ITU KEYMAT and KEYMAT BEZEL in the shown angle.

30. Open snap 3.

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31. Open snap 4.

32. Open snap 5.

33. Remove the KEYMAT BEZEL.

34. Remove the ITU KEYMAT.

35. Unscrew the Torx Plus® size 6 SCREWS in the order shown. **For assembly, use the reverse order with a torque setting of 23Ncm.**

    Note: Always use new SCREWS when reassembling the unit.

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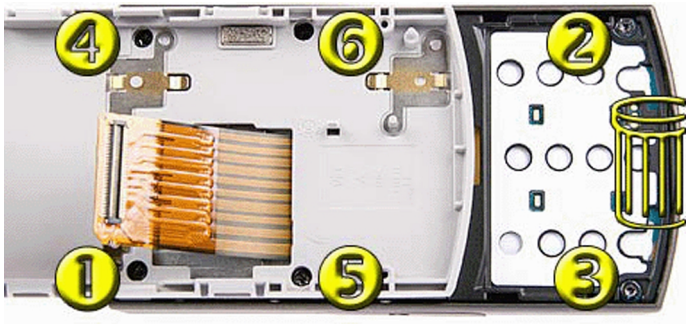
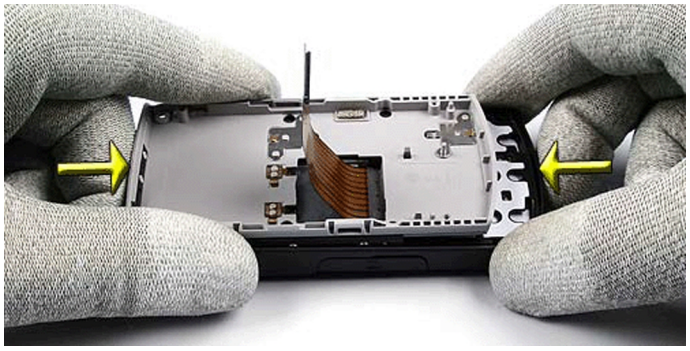


36. Close the SLIDE ASSY.



37. Remove the UI FRAME SPARE include the ENGINE SHIELD ASSY.

38. Now, separate the parts from each other.

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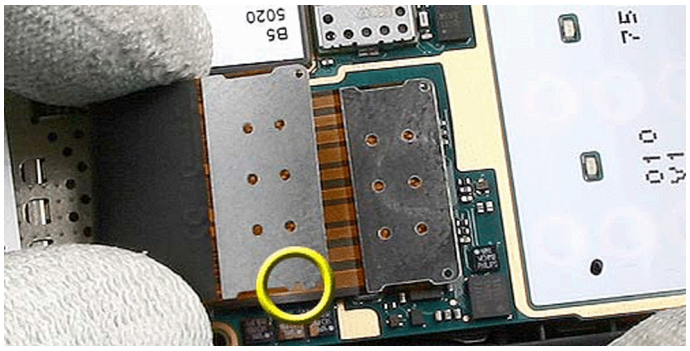
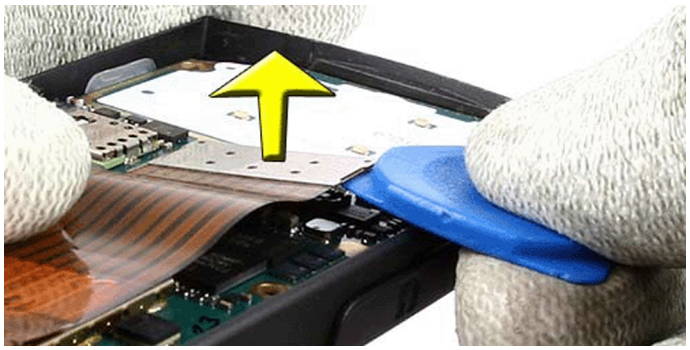
39. **For assembly only:** Mind the correct assembling when connecting the FLEX I/CONN MODULE to the ENGINE MODULE.

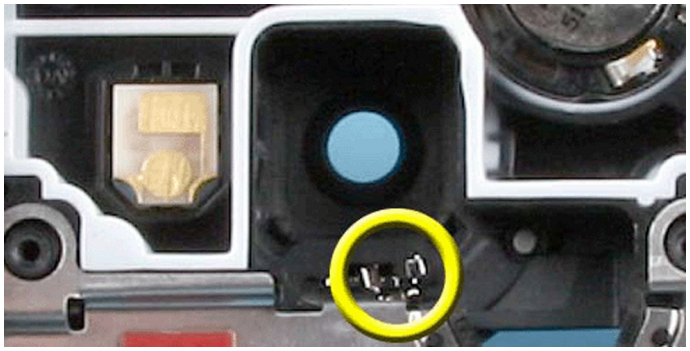


40. Open the FLEX I connector carefully.



41. Lift up the ENGINE MODULE a bit, and remove it.

42. **For assembly only:** For assembling, ensure the correct position of the CAMERA MACRO KEY in the B-COVER ASSY and...



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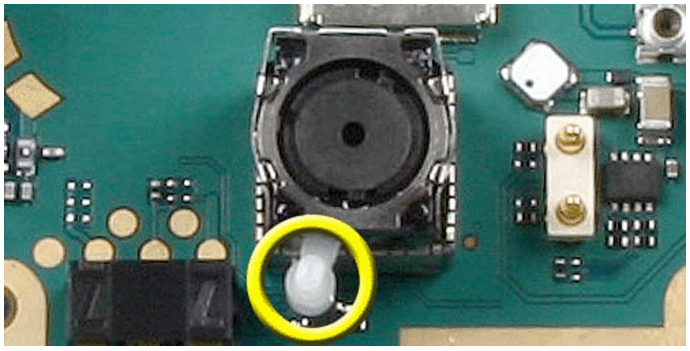
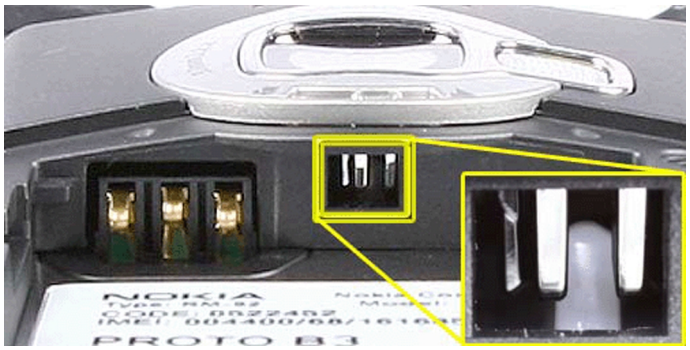
43. ...the camera macro lever of the 3MP CAMERA on the ENGINE MODULE.



44. **For assembly only:** After placing the ENGINE MODULE into the B-COVER ASSY check the window inside the battery housing if the CAMERA MACRO KEY and camera macro lever correct fit together.



45. Remove the VIBRA.

46. Use the DC-Plug to remove the DC-JACK.

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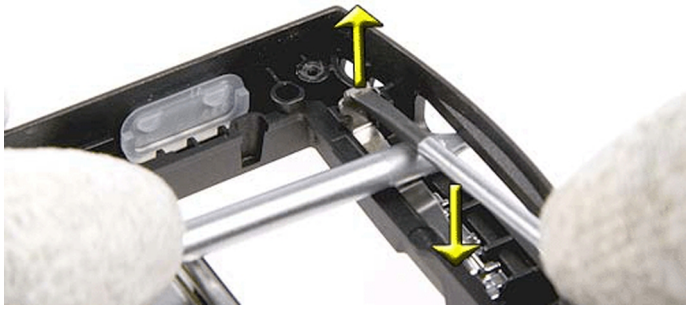
47. Use the dental tool to remove the MICROPHONE.

48. Use a torx driver as a fulcrum when removing the C-COVER CATCH SPRING.



49. The C-COVER CATCH drops out easily.

50. Push out the CAMERA KEY. Mind the correct assembling of the CAMERA KEY (small picture).

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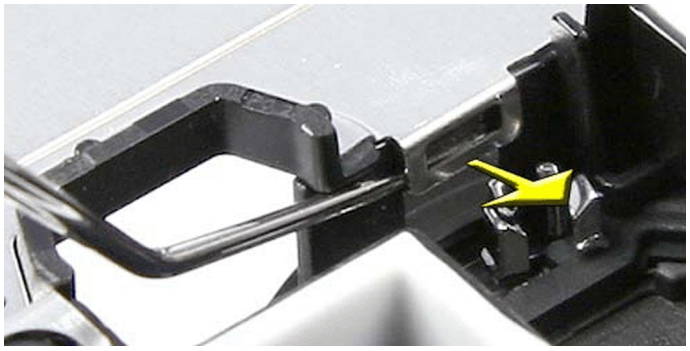
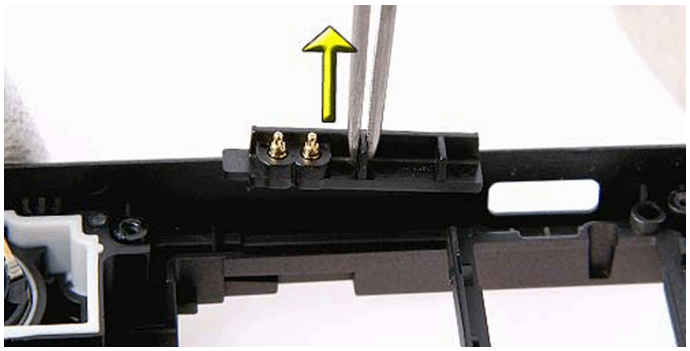
51. Unlock the snap of the BATTERY BASE ASSY.



52. Gently, remove the BATTERY BASE ASSY.

53. Remove the BLUETOOTH ANTENNA ASSY.



54. Remove the SD CARD DOOR.

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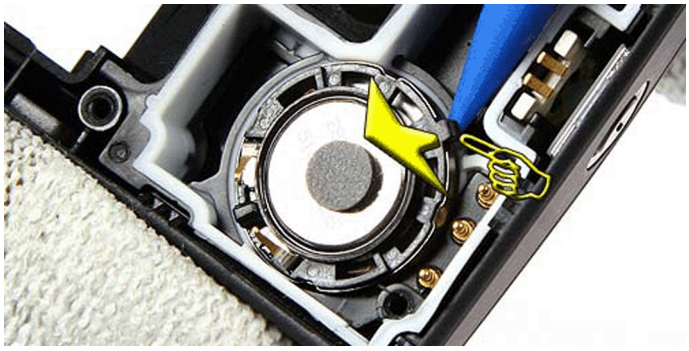
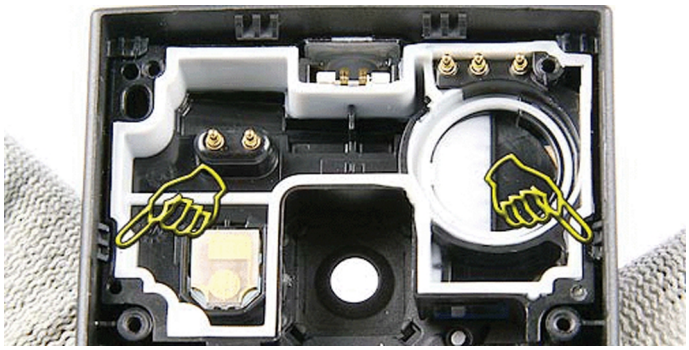
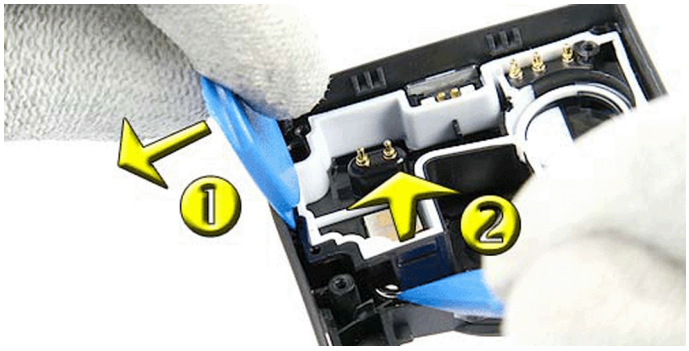
55. Lift up the IHF SPEAKER a bit, and remove it. Note the guide pin when re-assembling the IHF SPEAKER.



56. Note the two snaps on both sides of the B-COVER ASSY. The ANTENNA ASSY is attached to the B-COVER very tight.



57. First, unlock the left snap with the SRT-6 (position 1) and hold it while levering up the ANTENNA ASSY with the SS-93 (position 2). Now fix with your thumb the lifted...



58. ...ANTENNA ASSY on the left side and unlock the right snap with the SRT-6.

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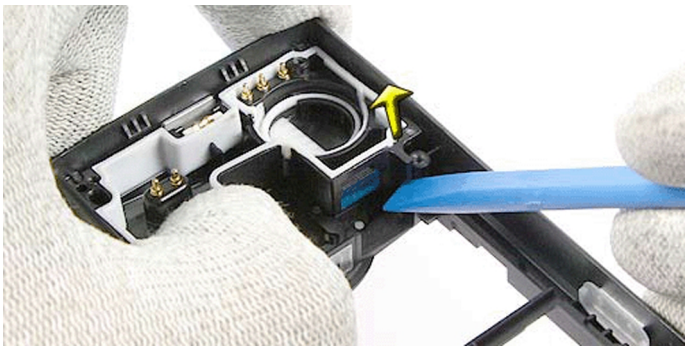
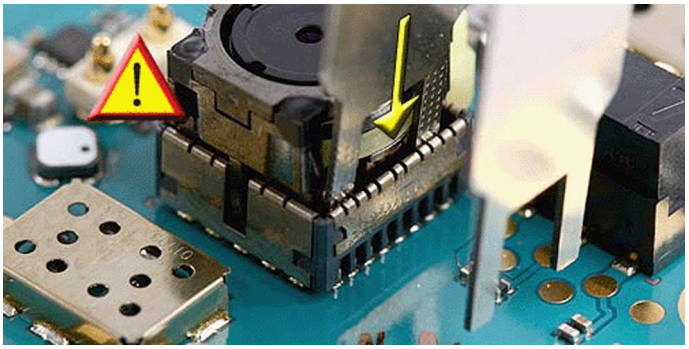
59. After the snap is unlocked, lift the right side of the ANTENNA ASSY. You still need moderate force to remove it from the B-COVER ASSY. Ensure not do damage the ANTENNA ASSY.

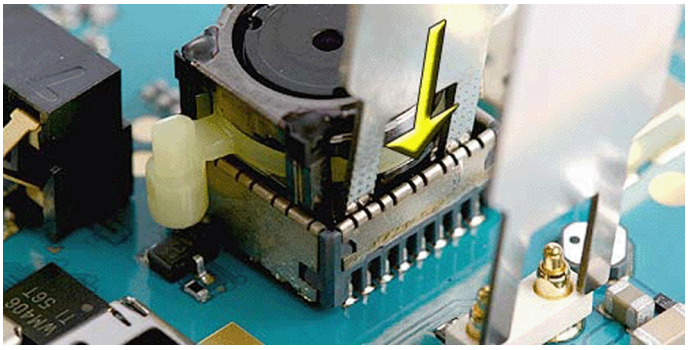


60. Push out the FLASH LED.

61. Unlock the snaps of the CAMERA by using the SS-45.



62. Continue on the other side of the CAMERA housing.



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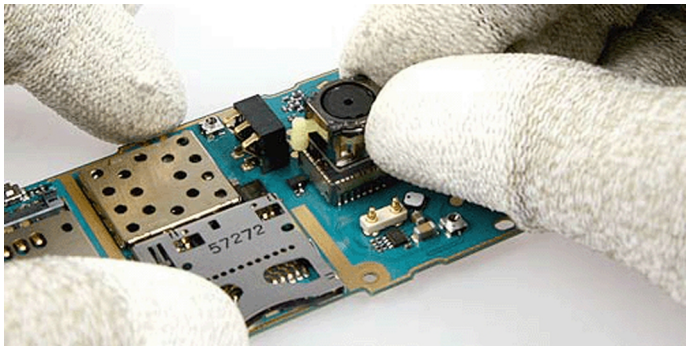
63. Gently remove the CAMERA.



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6 — BB Troubleshooting and Manual Tuning Guide

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Baseband troubleshooting

Context

This section is intended to be a guide for localising and repairing electrical faults. The fault repairing is divided into troubleshooting paths. The following main troubleshooting tree describes the different baseband troubleshooting paths to be followed in fault situations.

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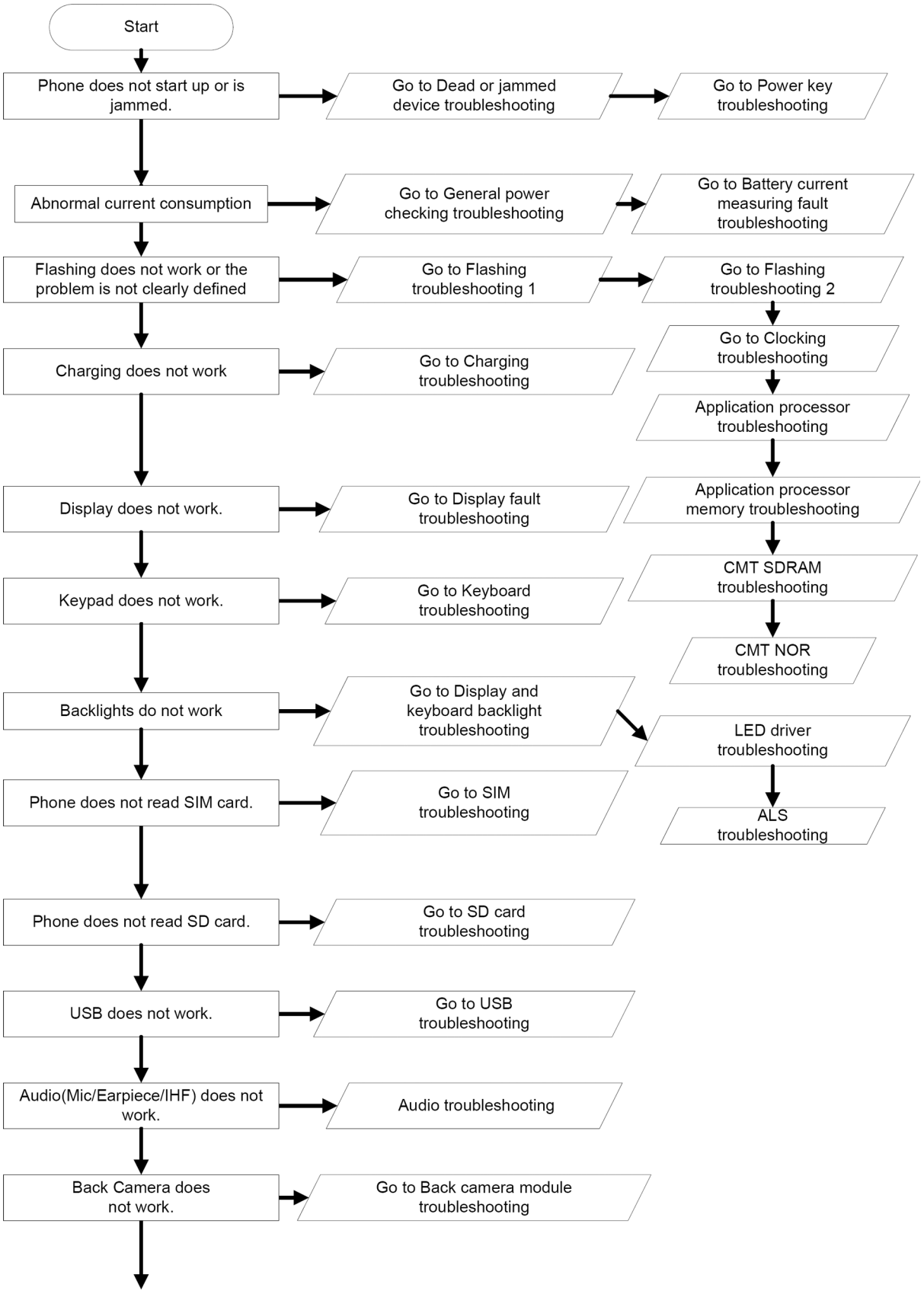
Troubleshooting flow



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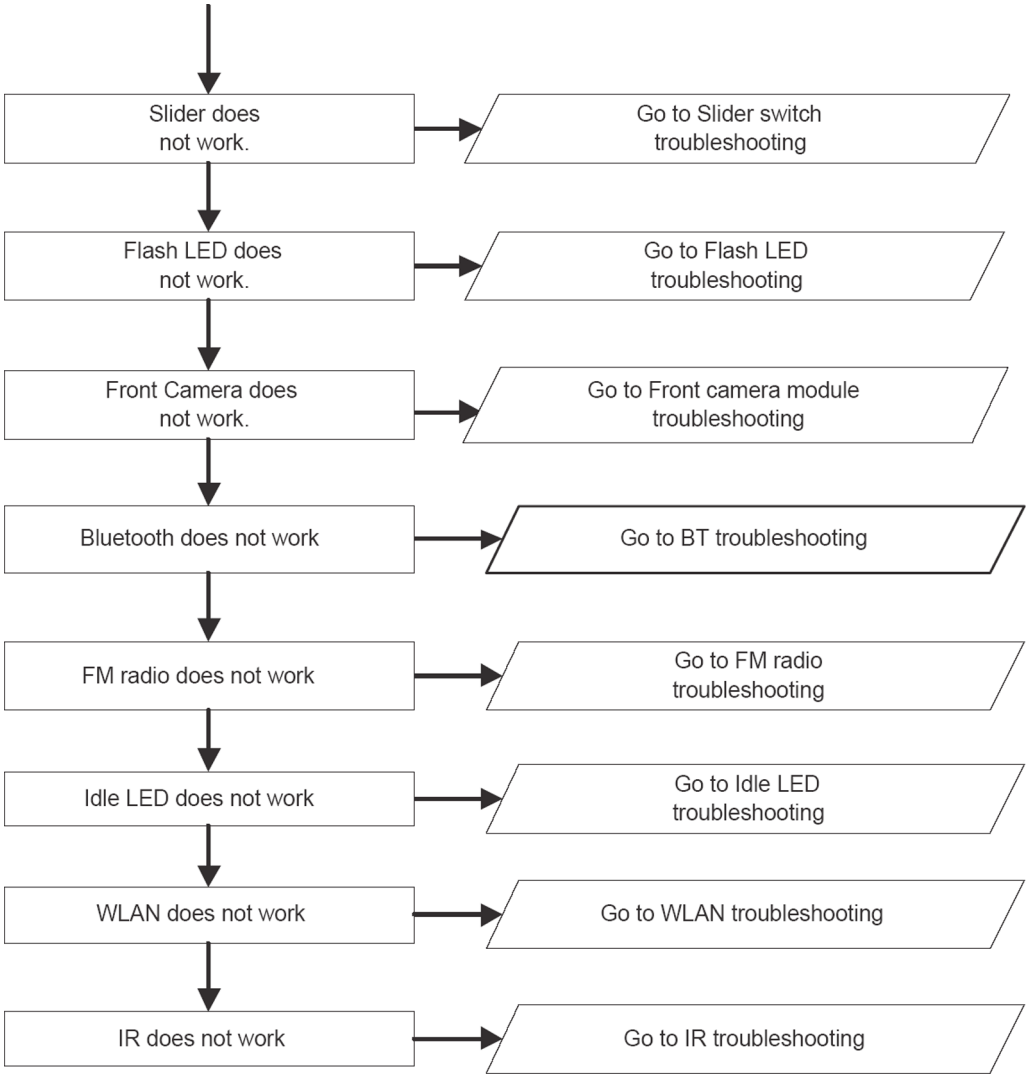

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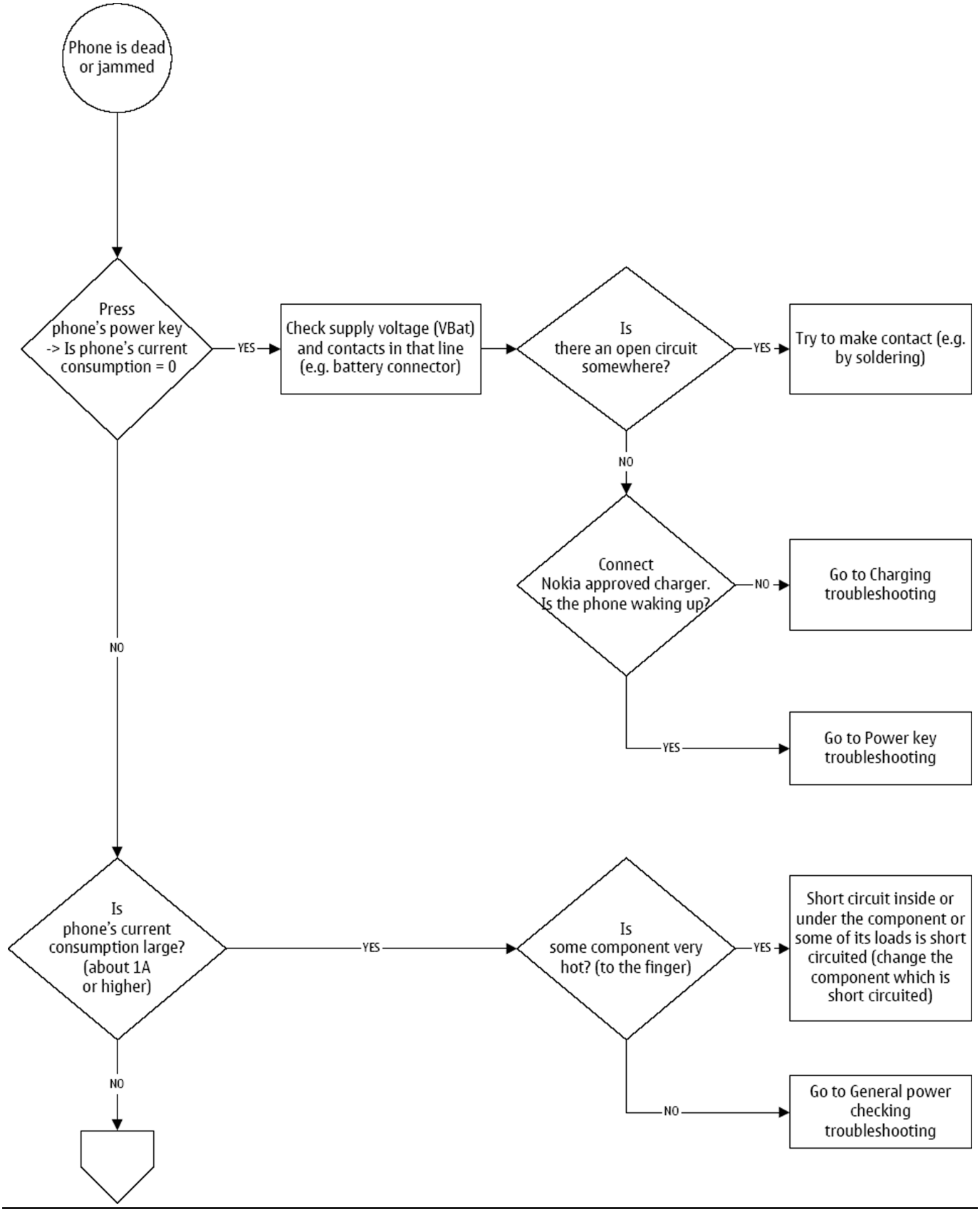
Dead or jammed device troubleshooting

Troubleshooting flow



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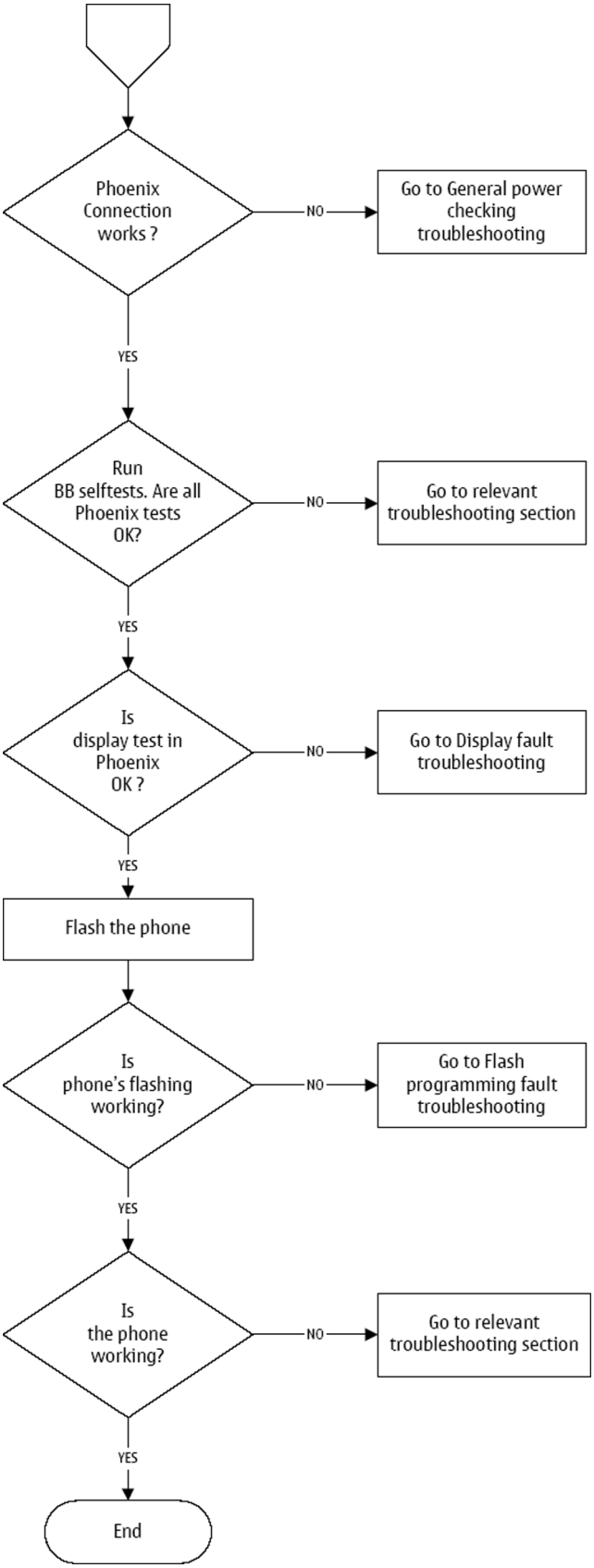

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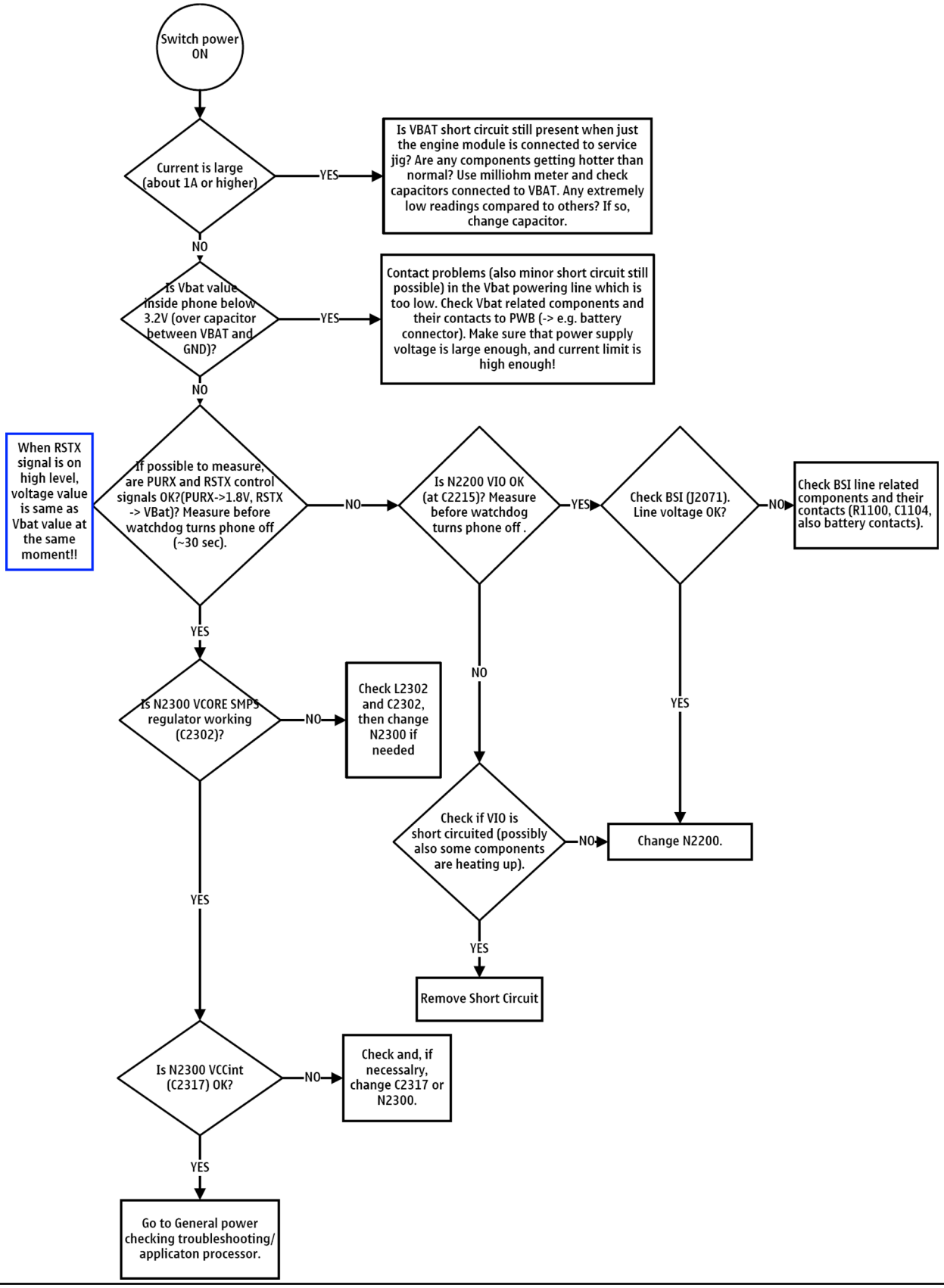
General power checking troubleshooting - CMT

Troubleshooting flow



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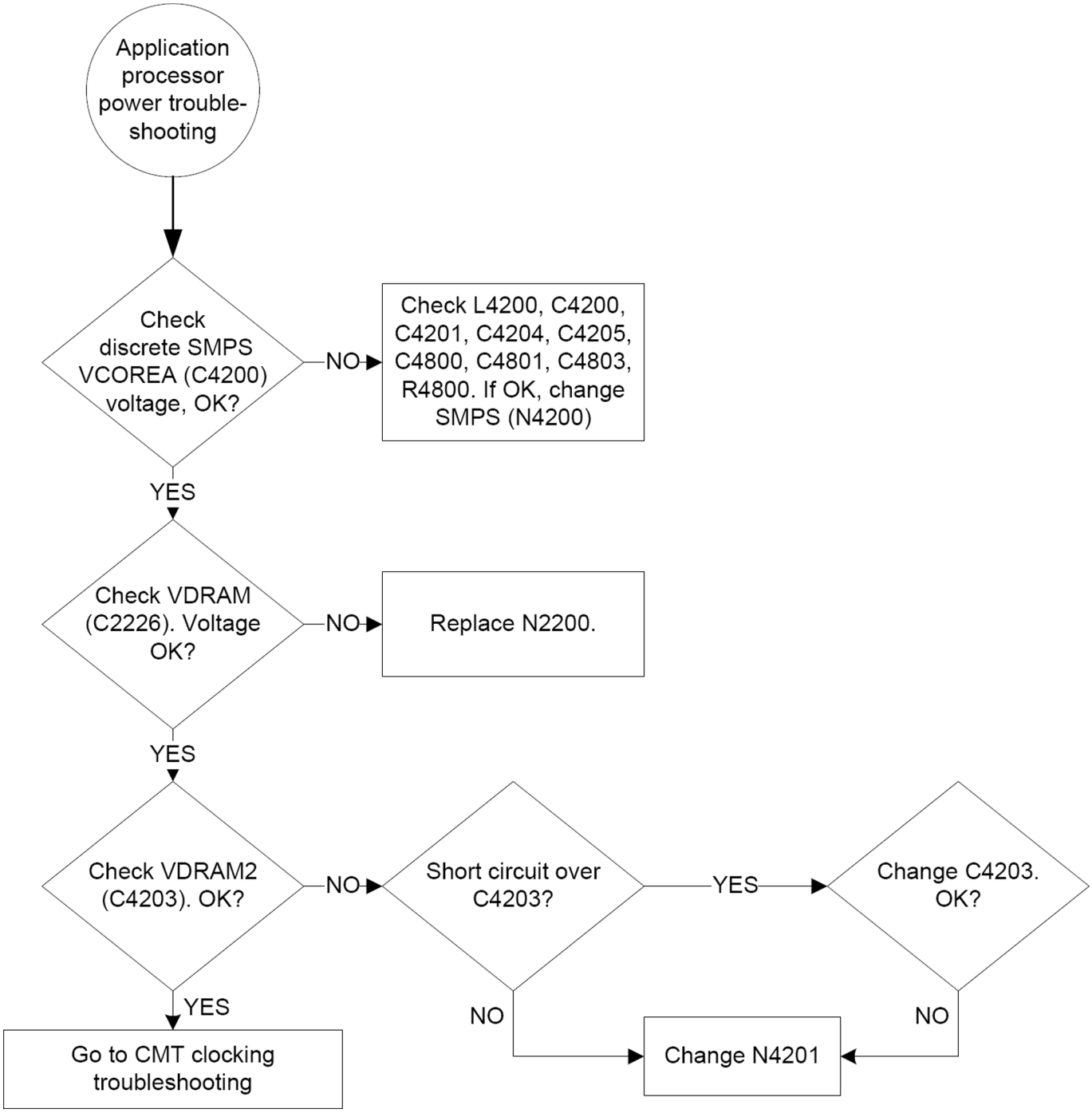
General power checking troubleshooting - application processor

Troubleshooting flow



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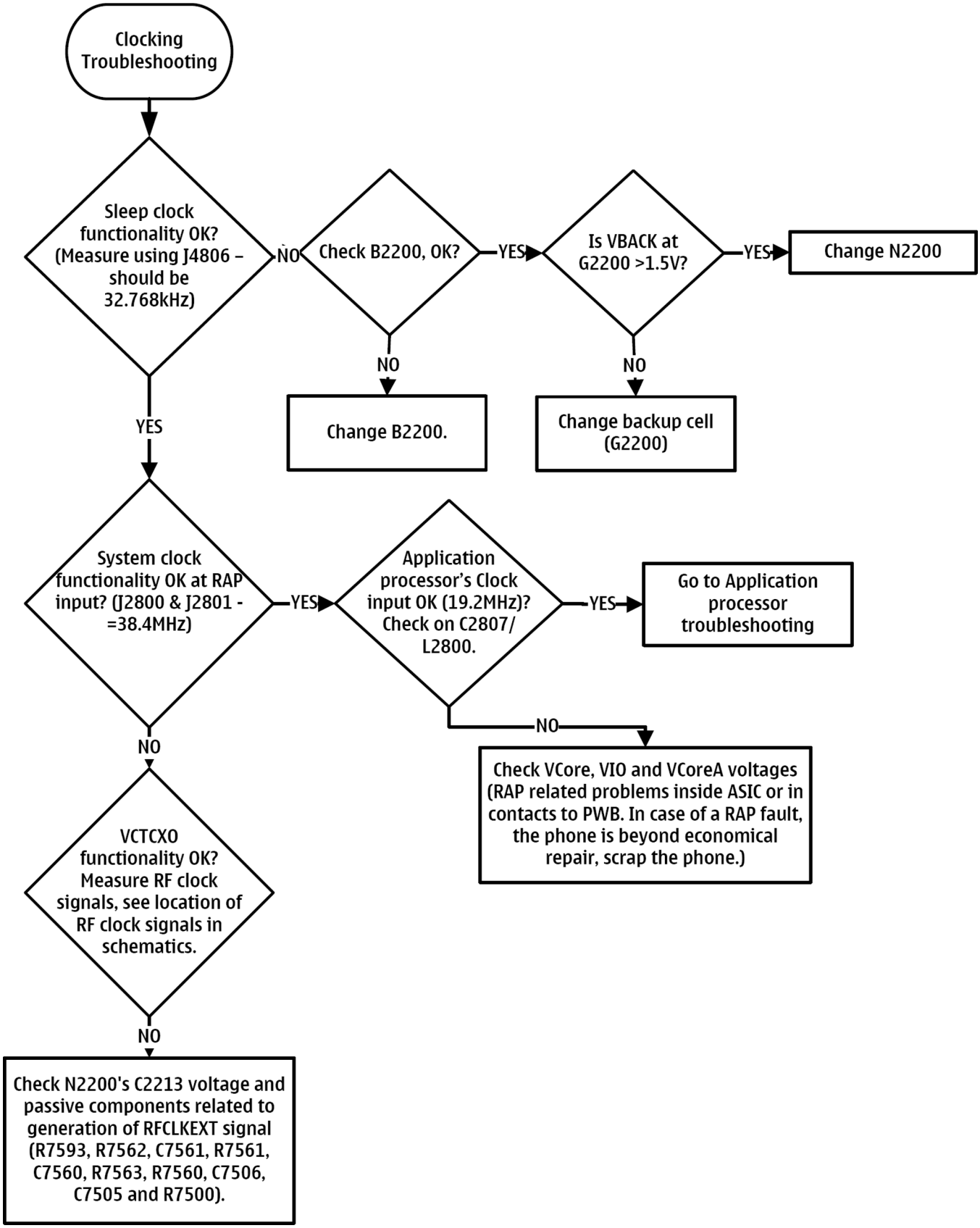
CMT clocking troubleshooting

Troubleshooting flow



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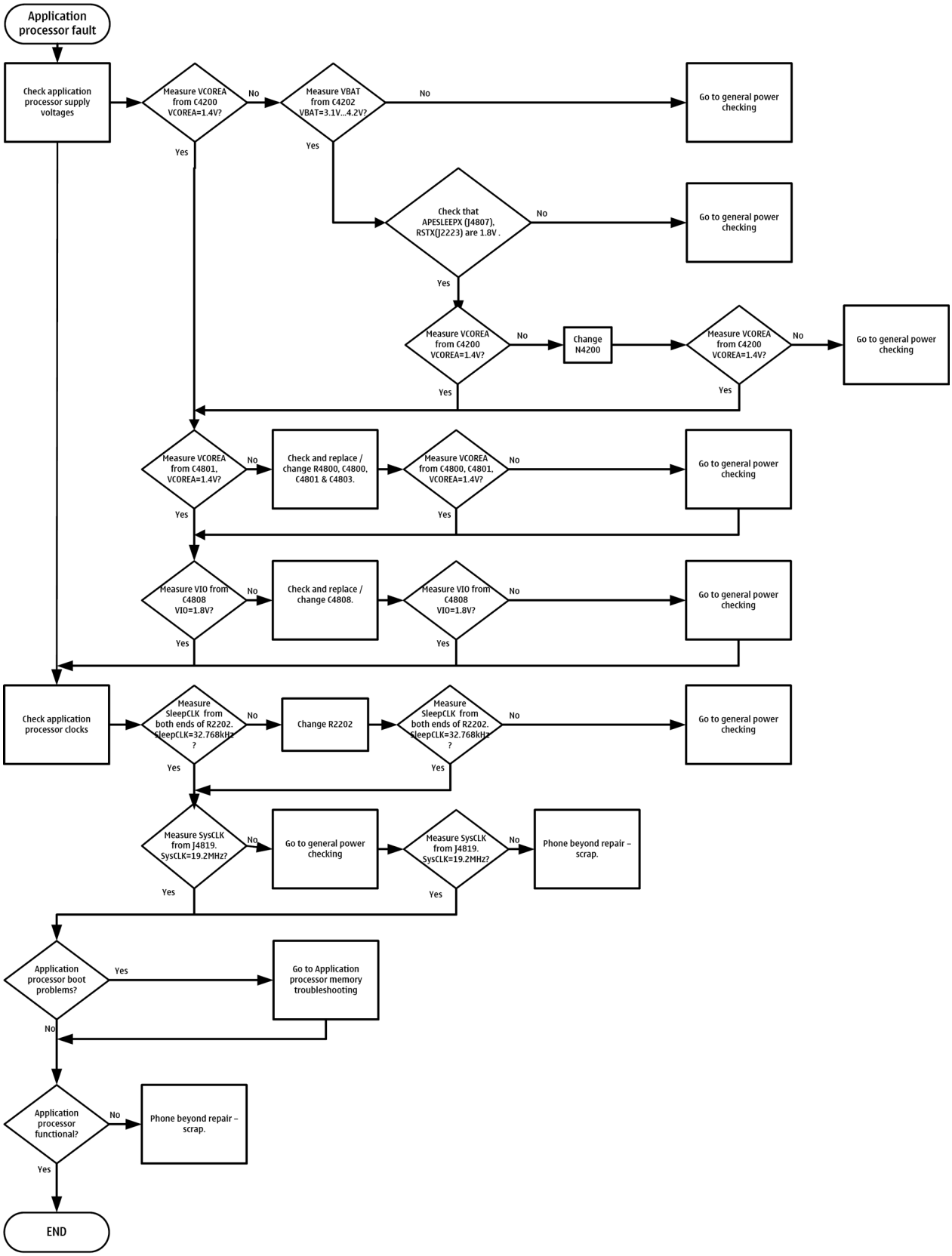
Application processor troubleshooting

Troubleshooting flow



Note: It is not possble to change the application processor. In this case, the PWB is beyond economical repair.

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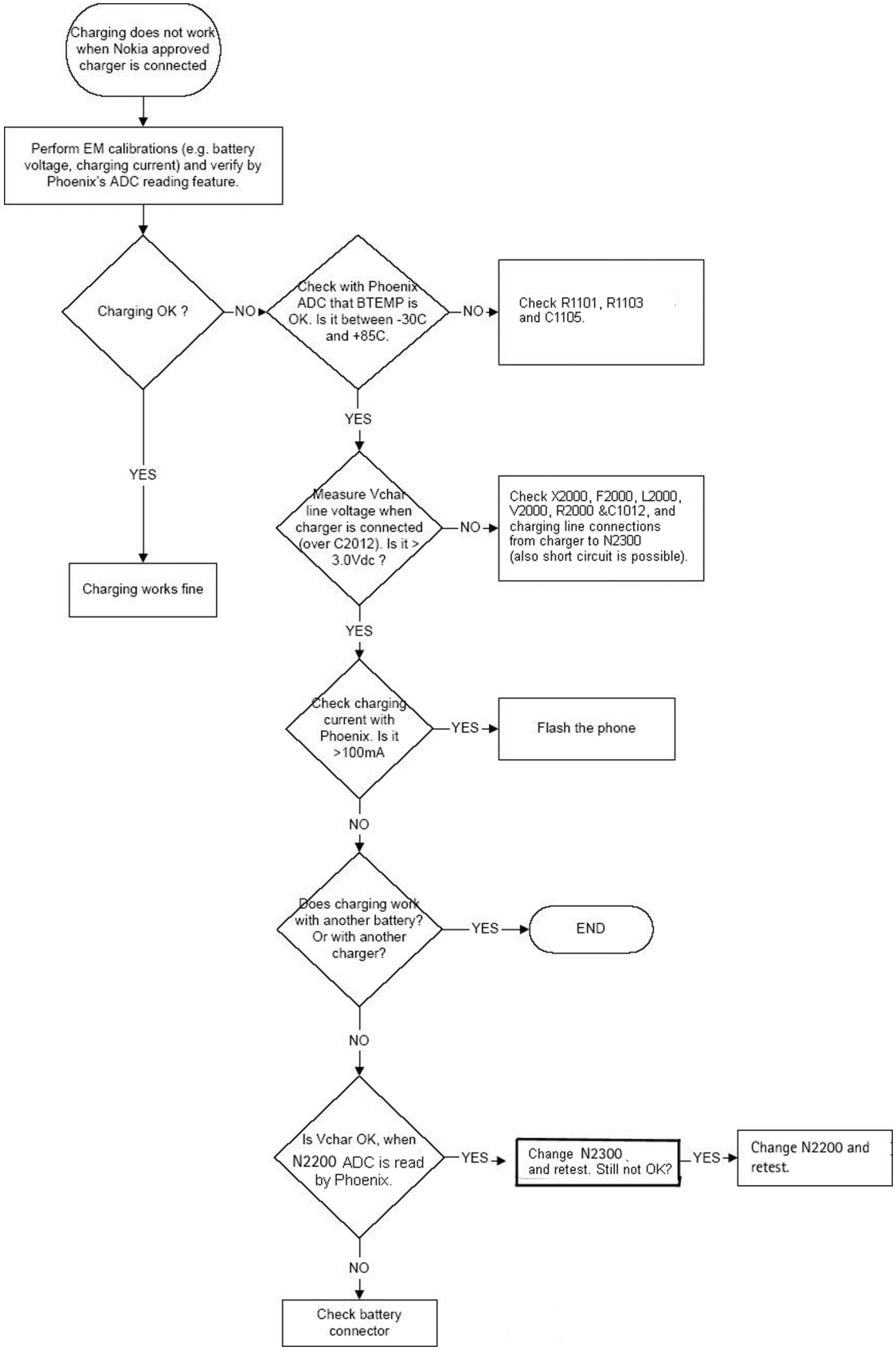
Charging troubleshooting

Troubleshooting flow



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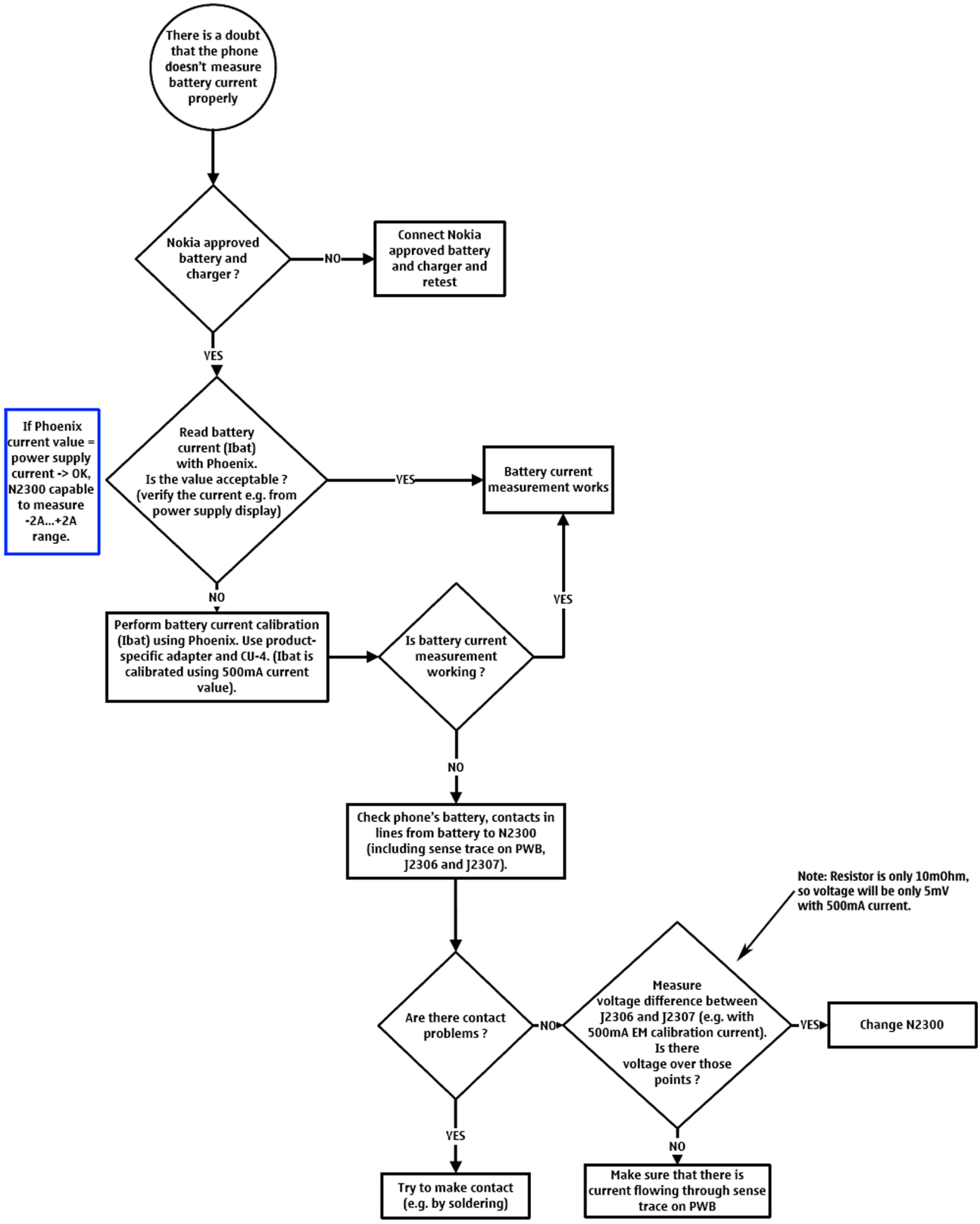
Battery current measuring fault troubleshooting

Troubleshooting flow



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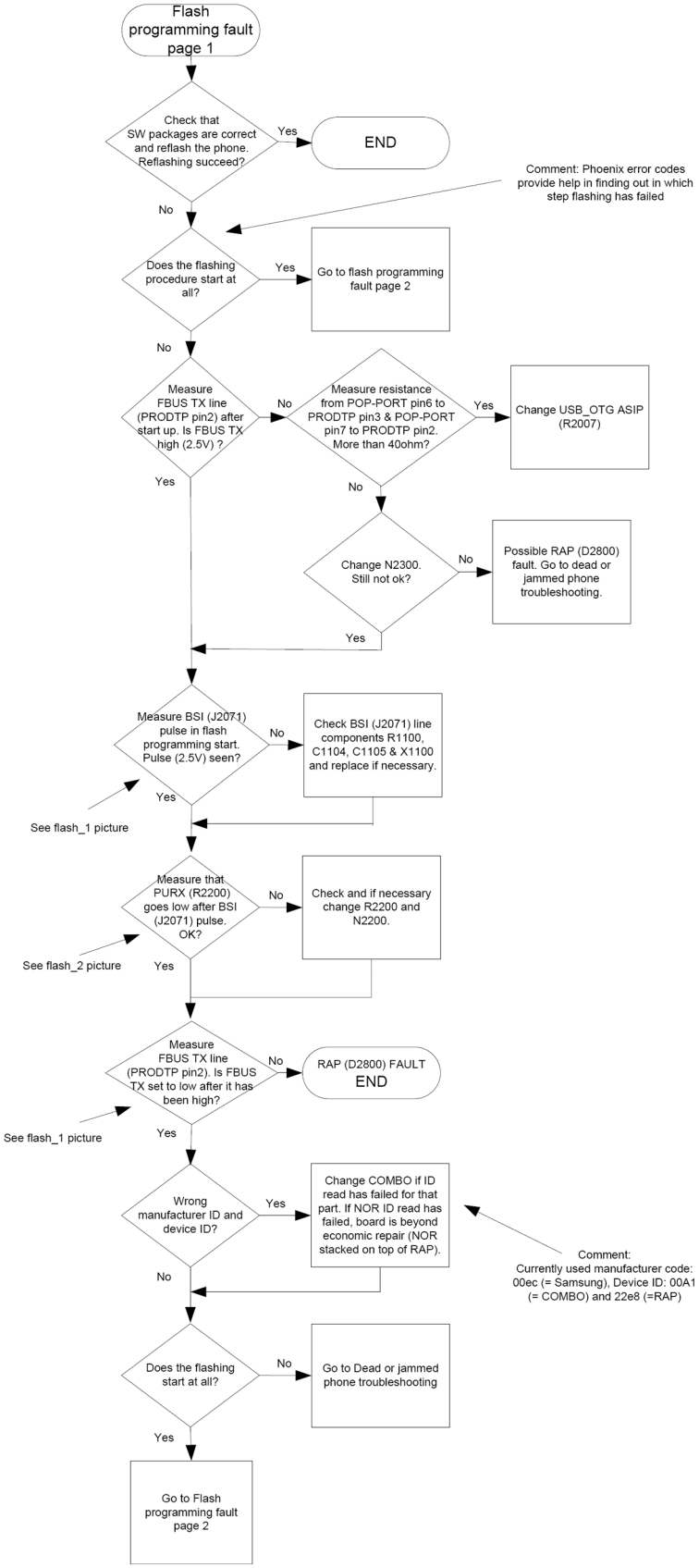
Flash programming fault troubleshooting

Troubleshooting flow



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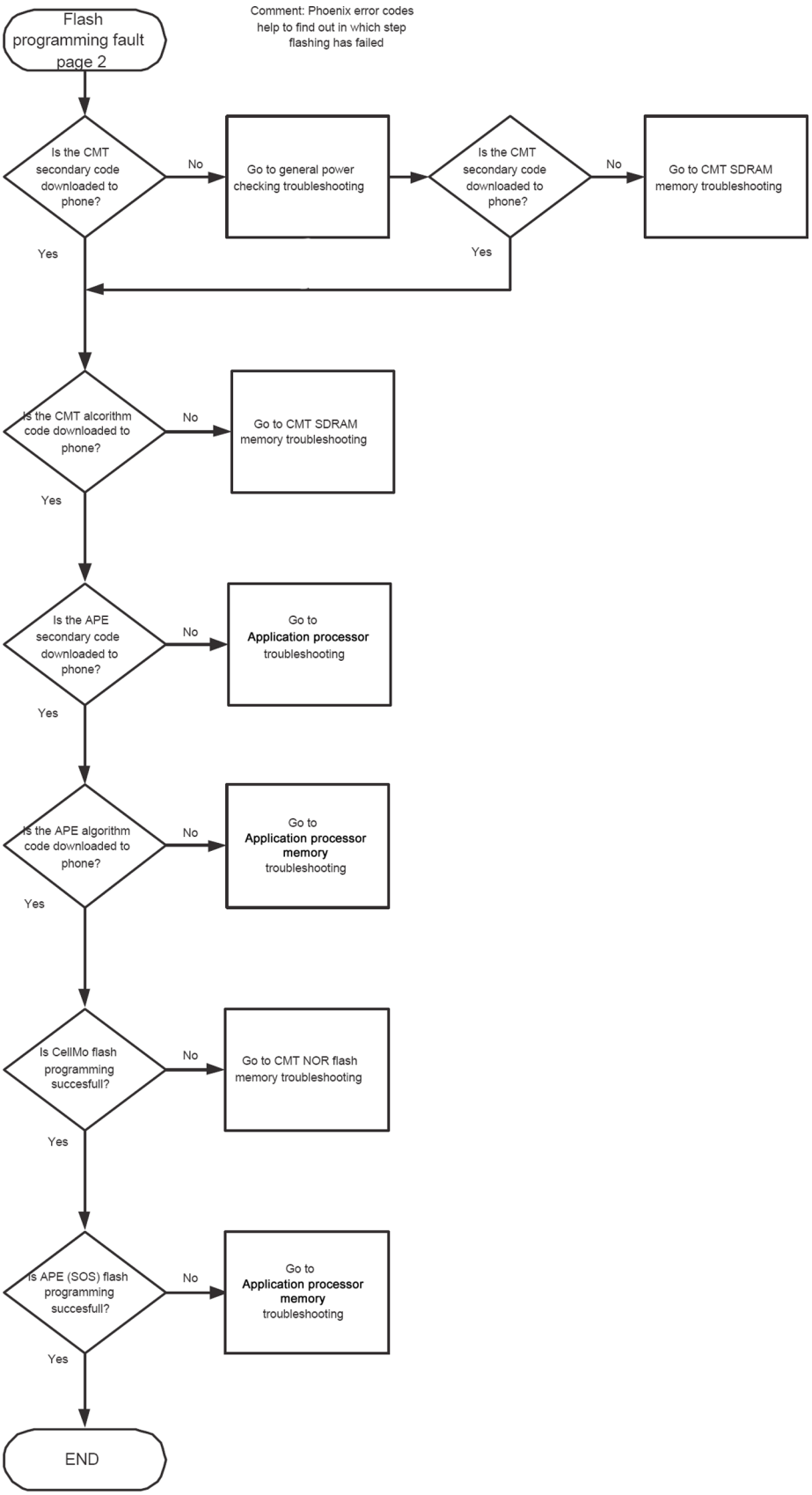

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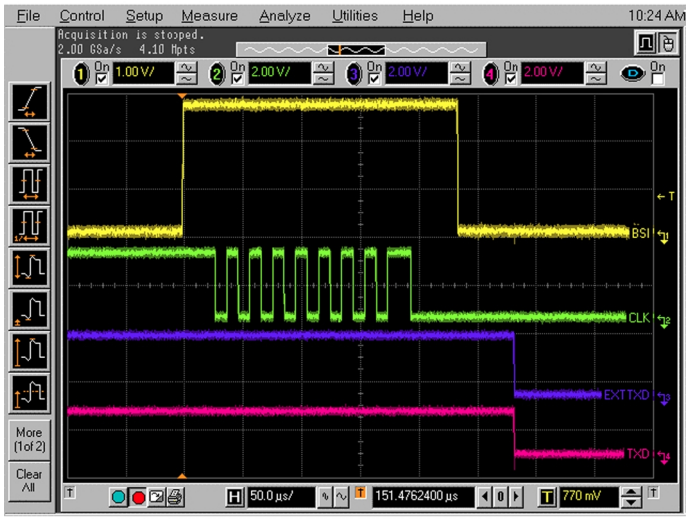

Figure 38 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

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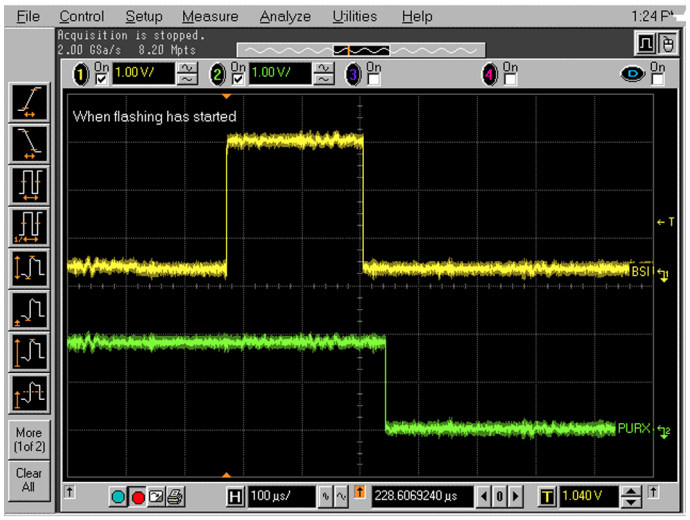

Figure 39 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

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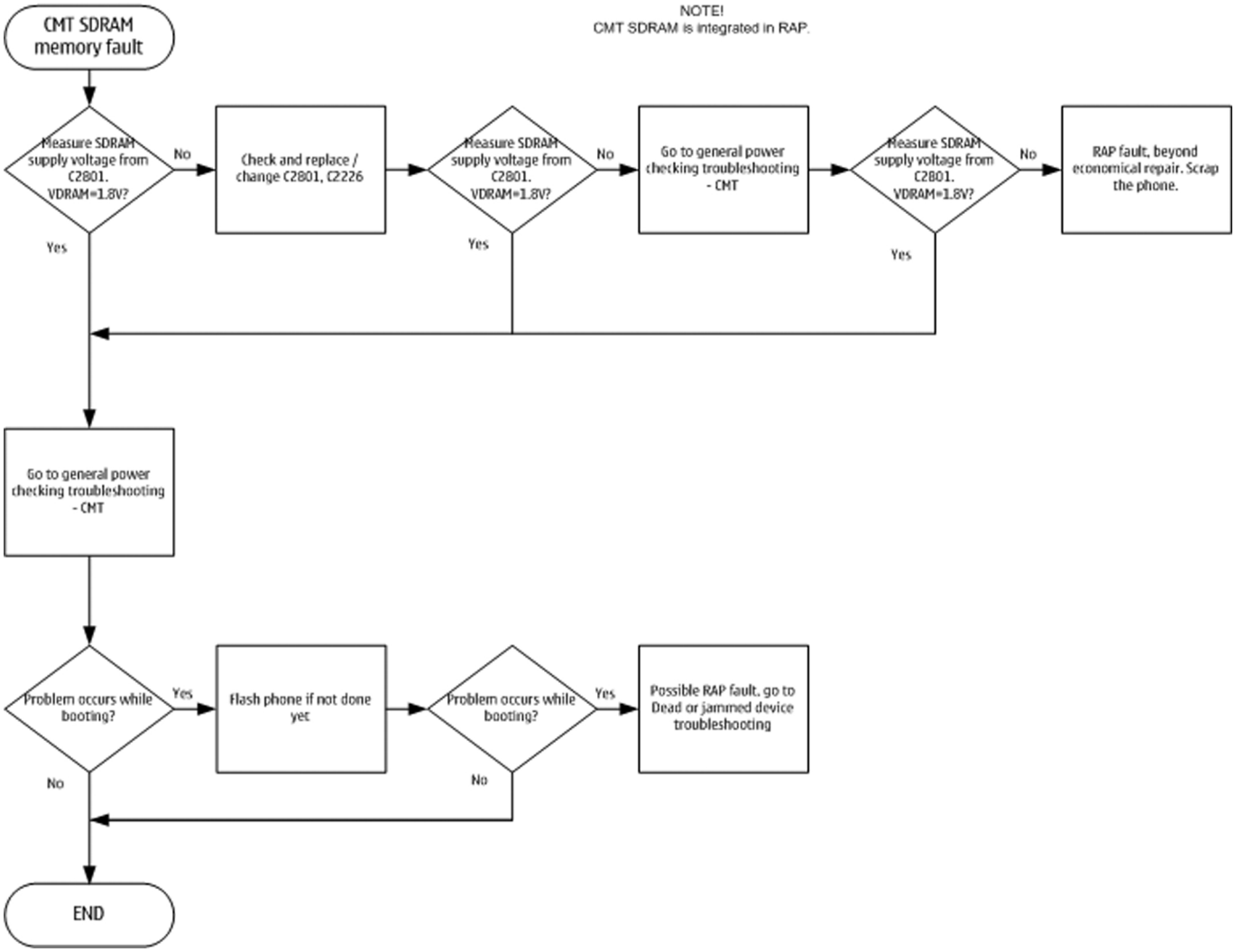
CMT SDRAM memory troubleshooting

Troubleshooting flow



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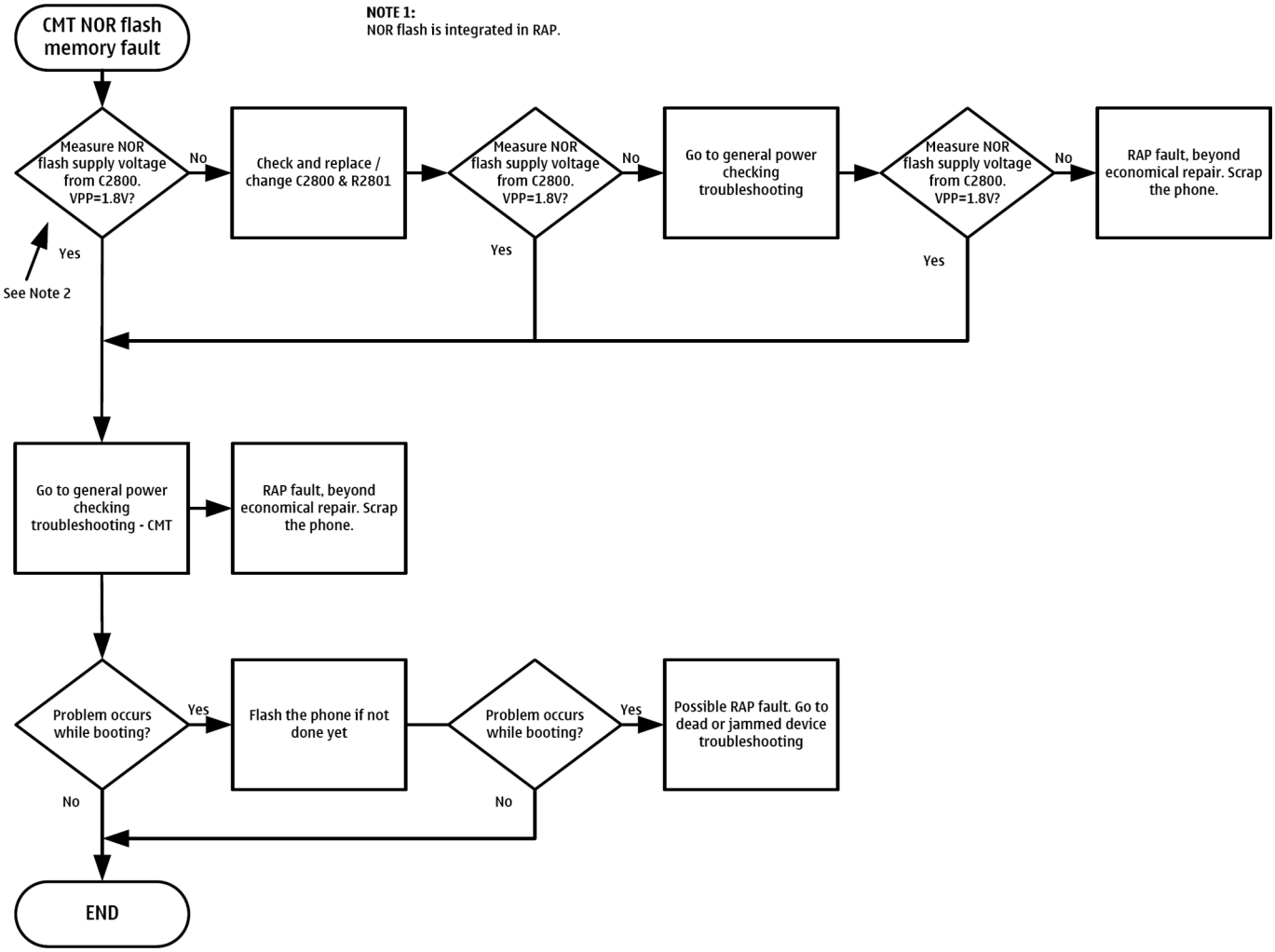
CMT NOR flash fault troubleshooting

Troubleshooting flow



NOTE 2: VPP is intitally 1.8V. When Vpp-LED ON FPS-10 goes ON VPP rises to 9V. When USB flashing is used, VPP is always 1.8V.

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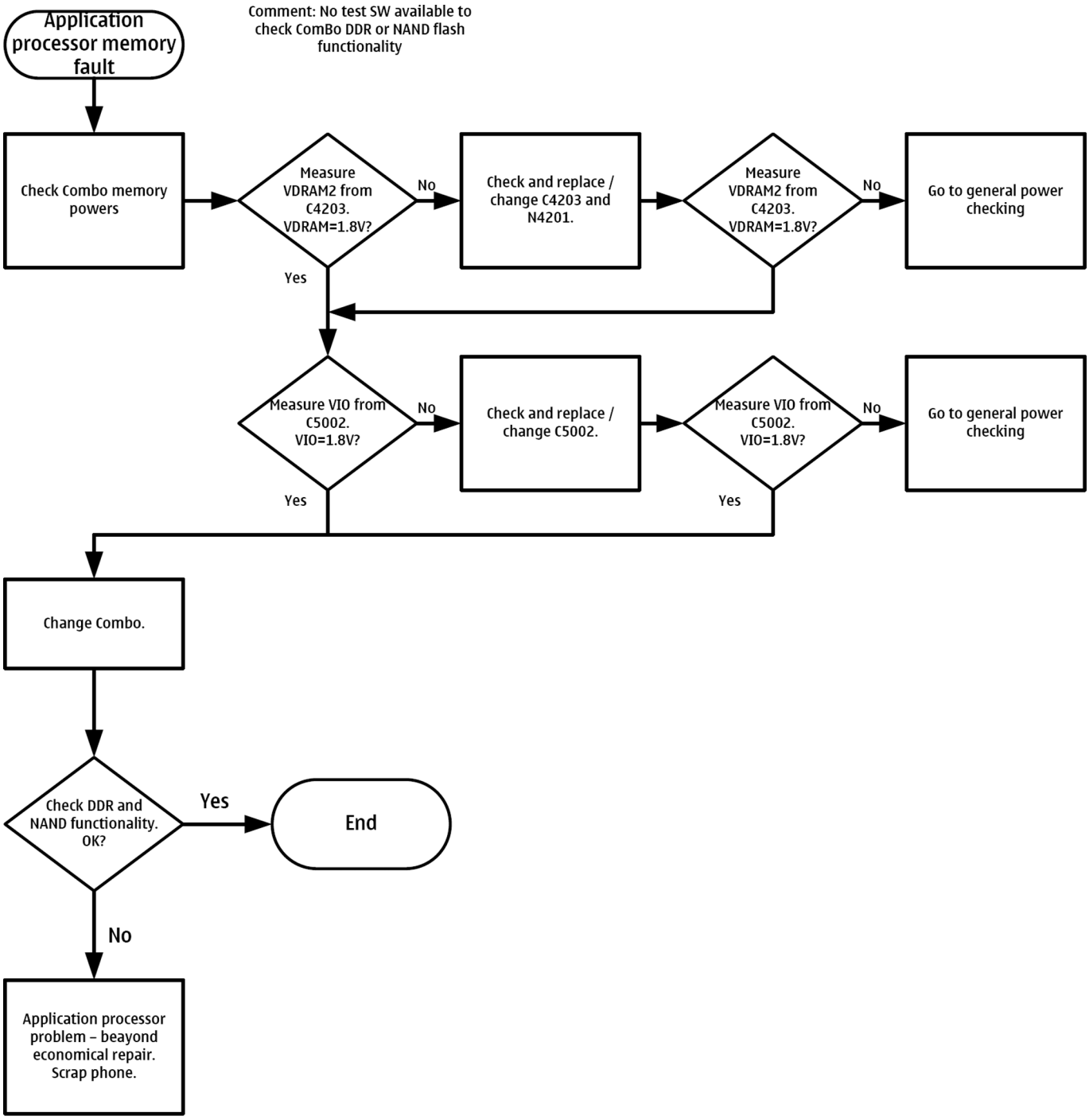
Application processor memory troubleshooting

Troubleshooting flow



Note: It is not possible to change the application processor. In this case, the PWB is beyond economical repair.

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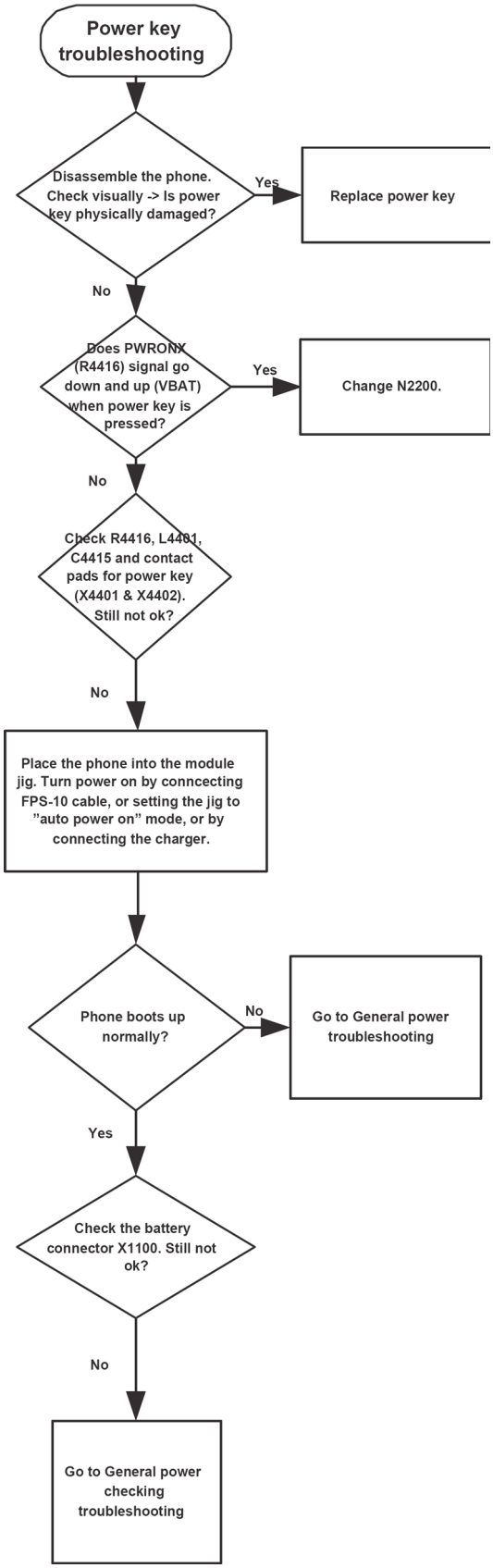
Power key troubleshooting

Troubleshooting flow



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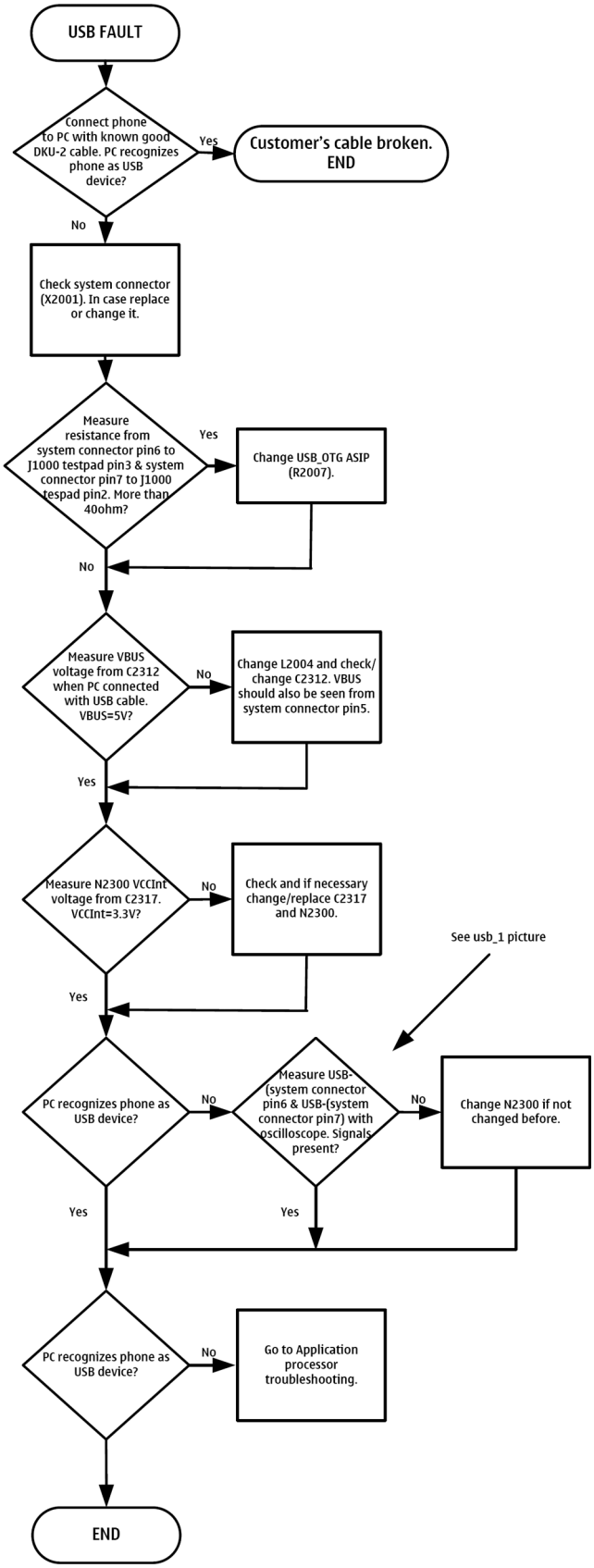
USB interface troubleshooting

Troubleshooting flow



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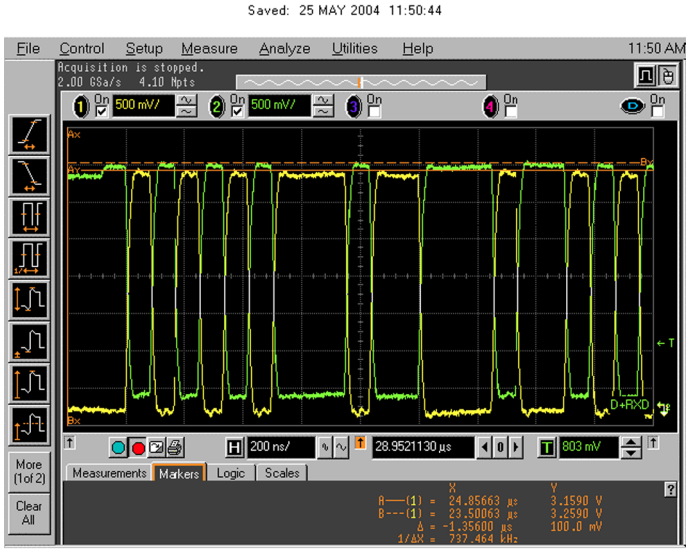

Figure 40 USB 1: D-TXD (system connector pin6) and D+RXD (system connector pin7) voltage levels when USB connected.

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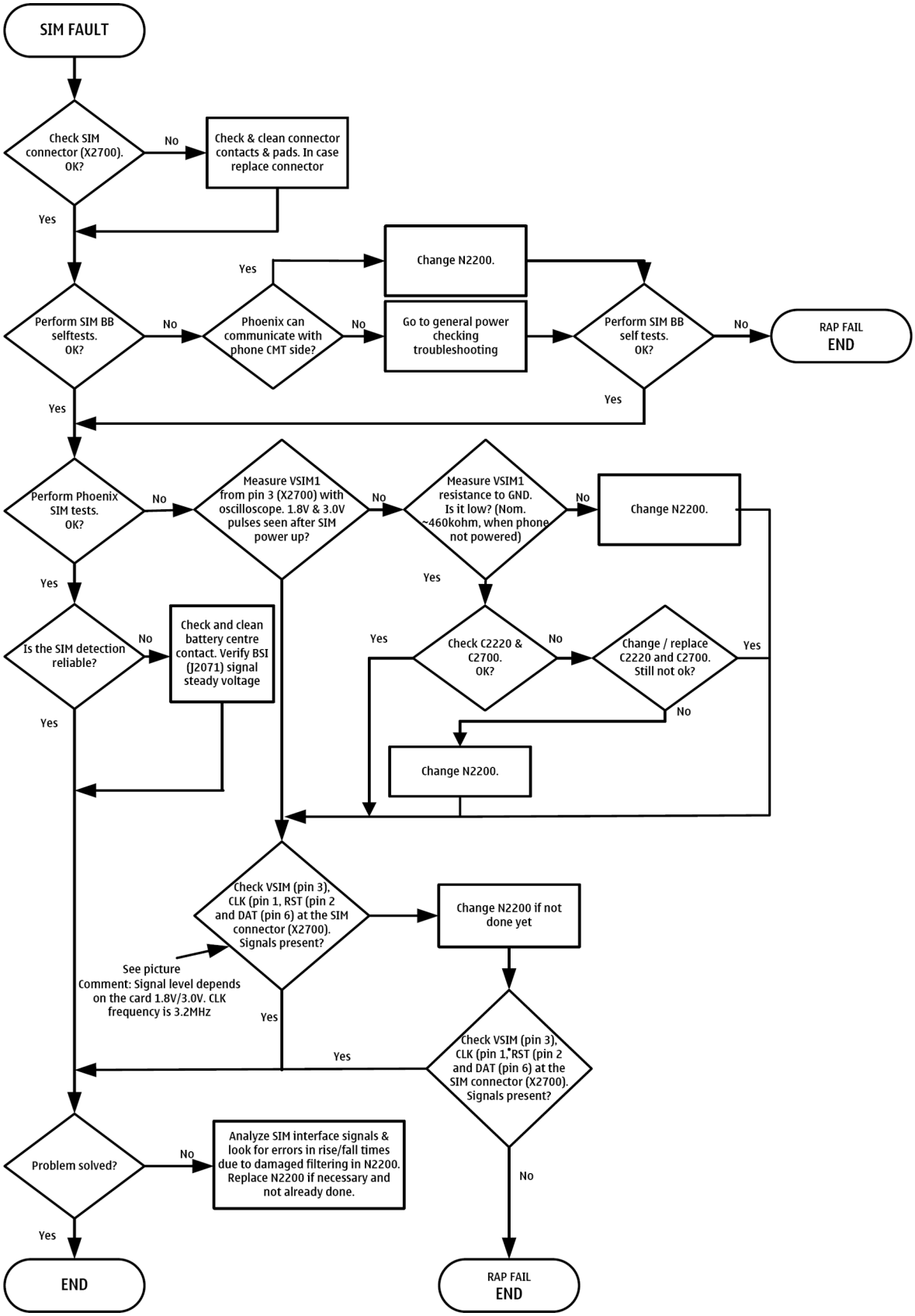
SIM card troubleshooting

Troubleshooting flow



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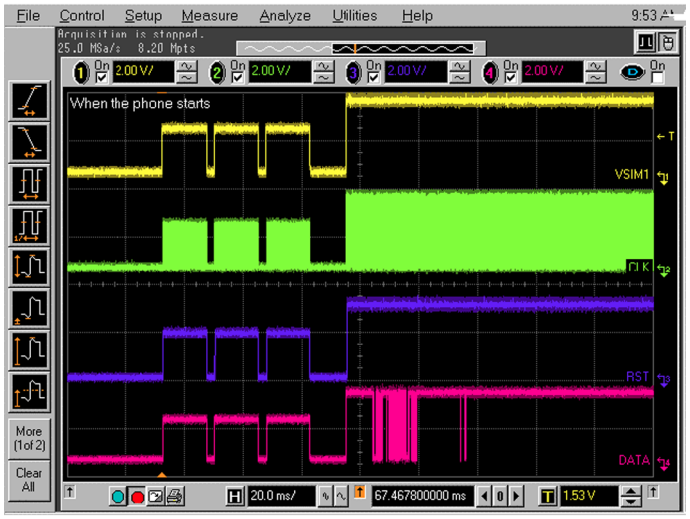

SIM CLK frequency = 3.2MHz (Take single triggered measurement in boot on the VSIM1 line).

Figure 41 SIM interface signals

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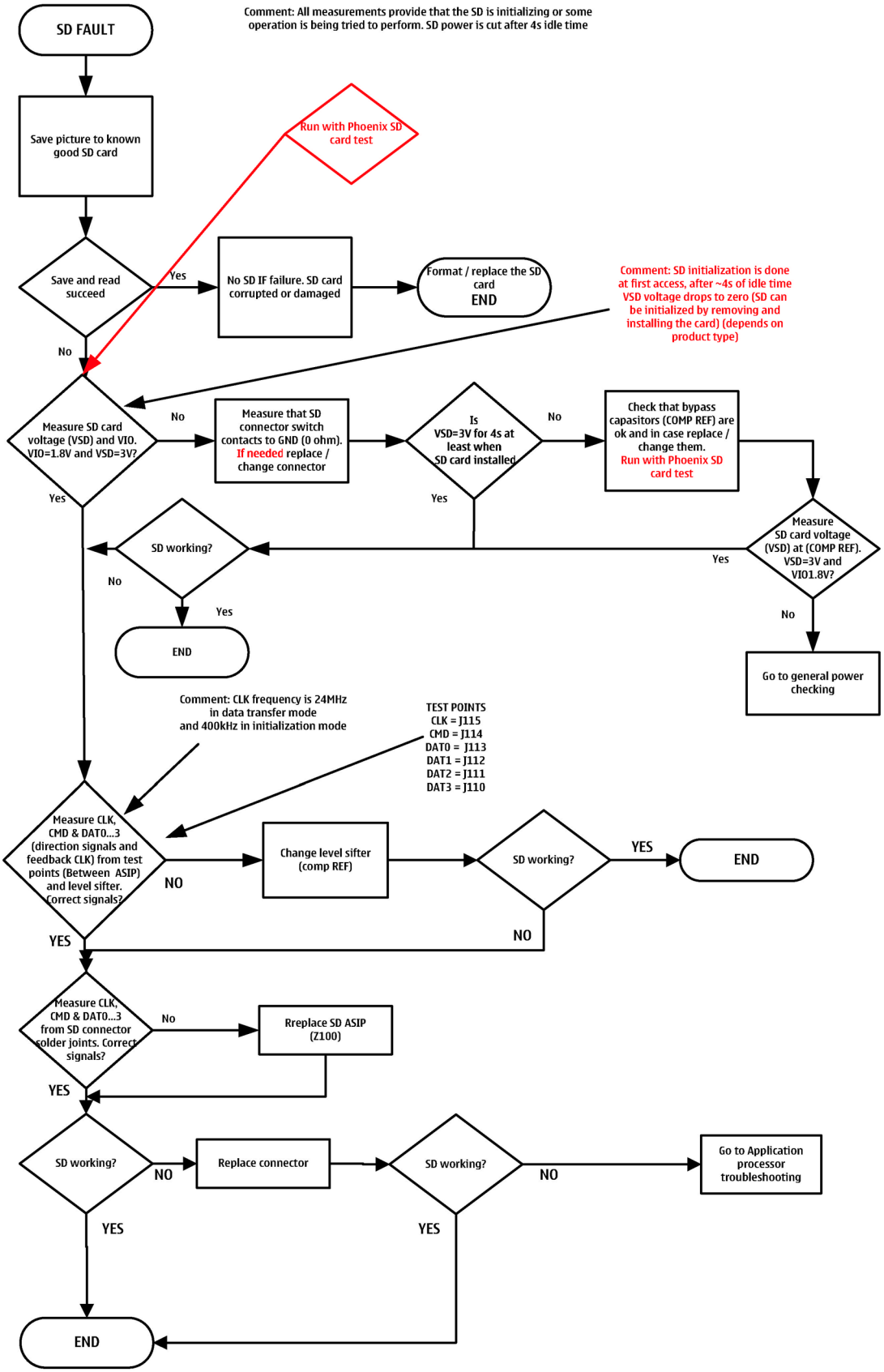
SD card troubleshooting

Troubleshooting flow



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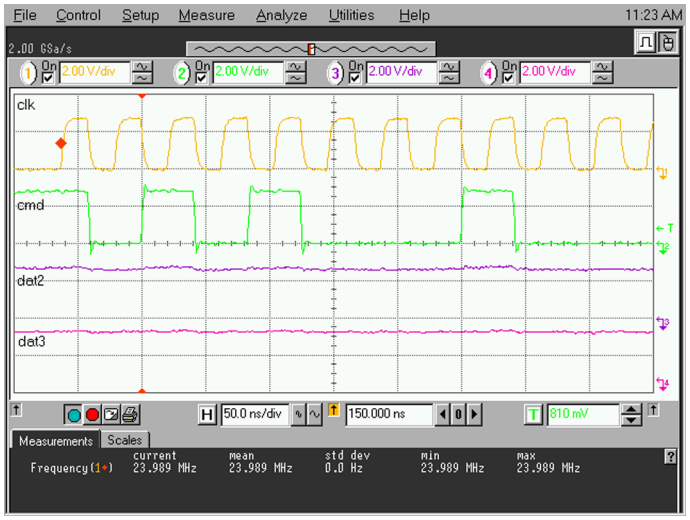

Figure 42 SD clk cdm diagram

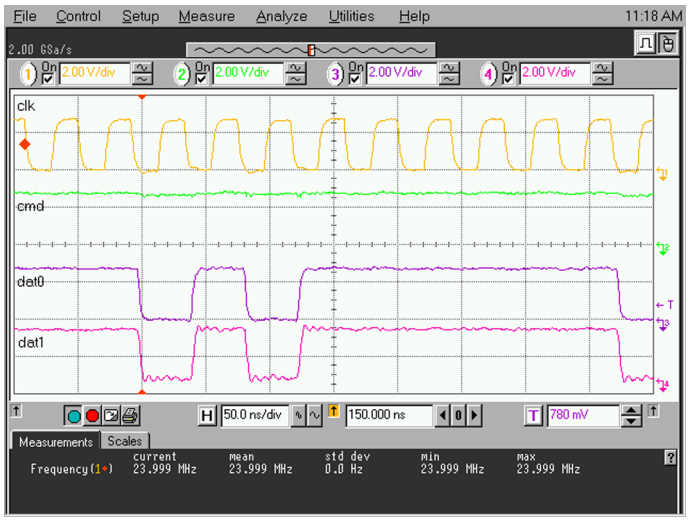

Figure 43 SD data 0_1 diagram

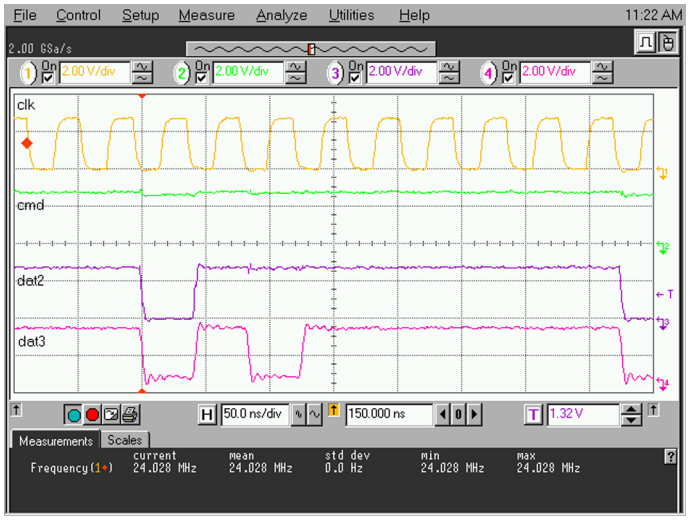

Figure 44 SD data 2_3 diagram

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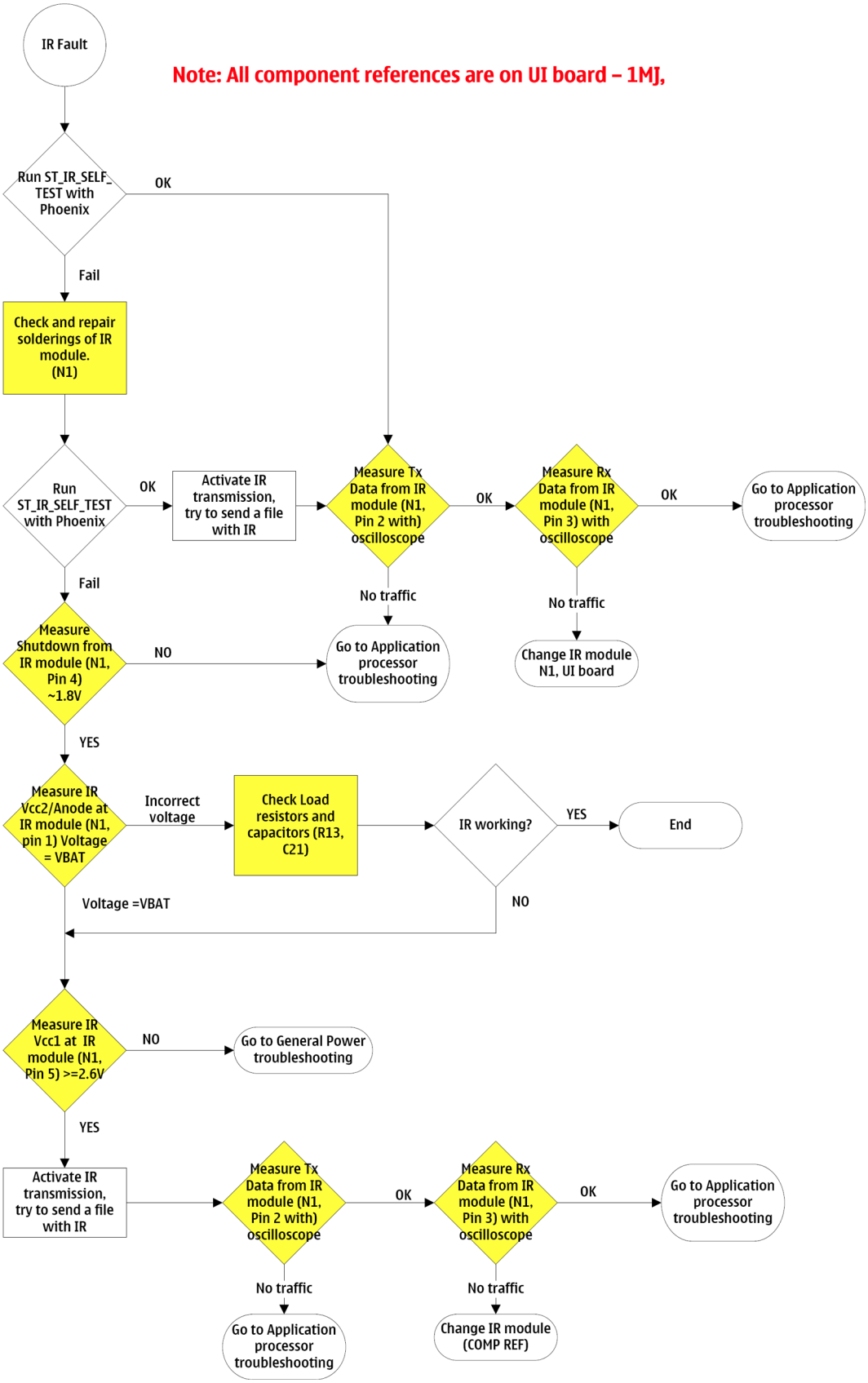
IrDA troubleshooting

Troubleshooting flow



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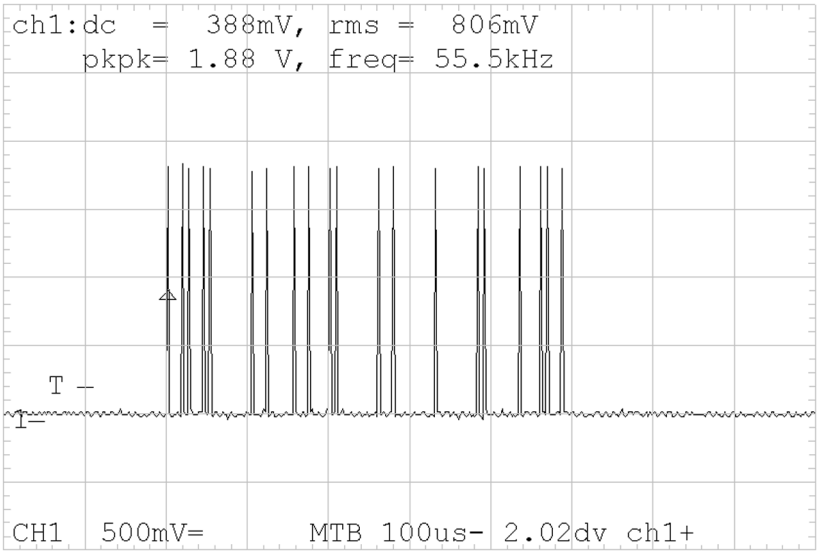

Figure 45 IR TX diagram

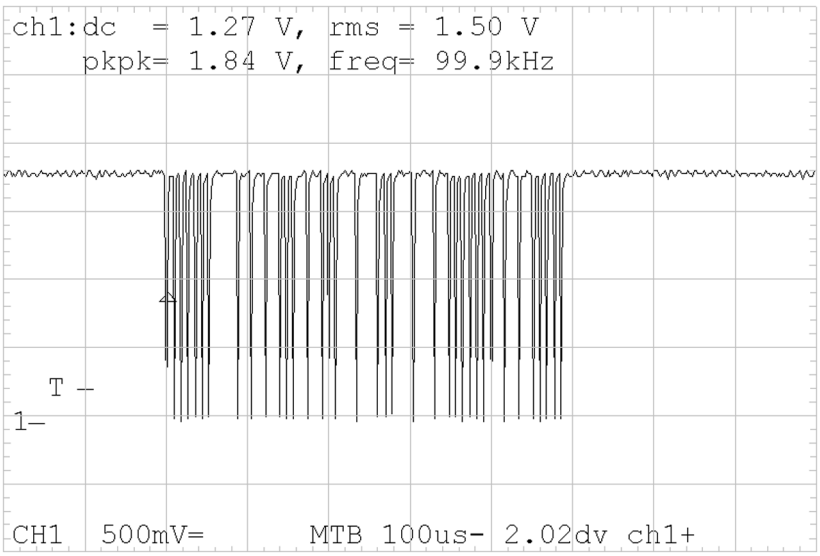

Figure 46 IR RX diagram

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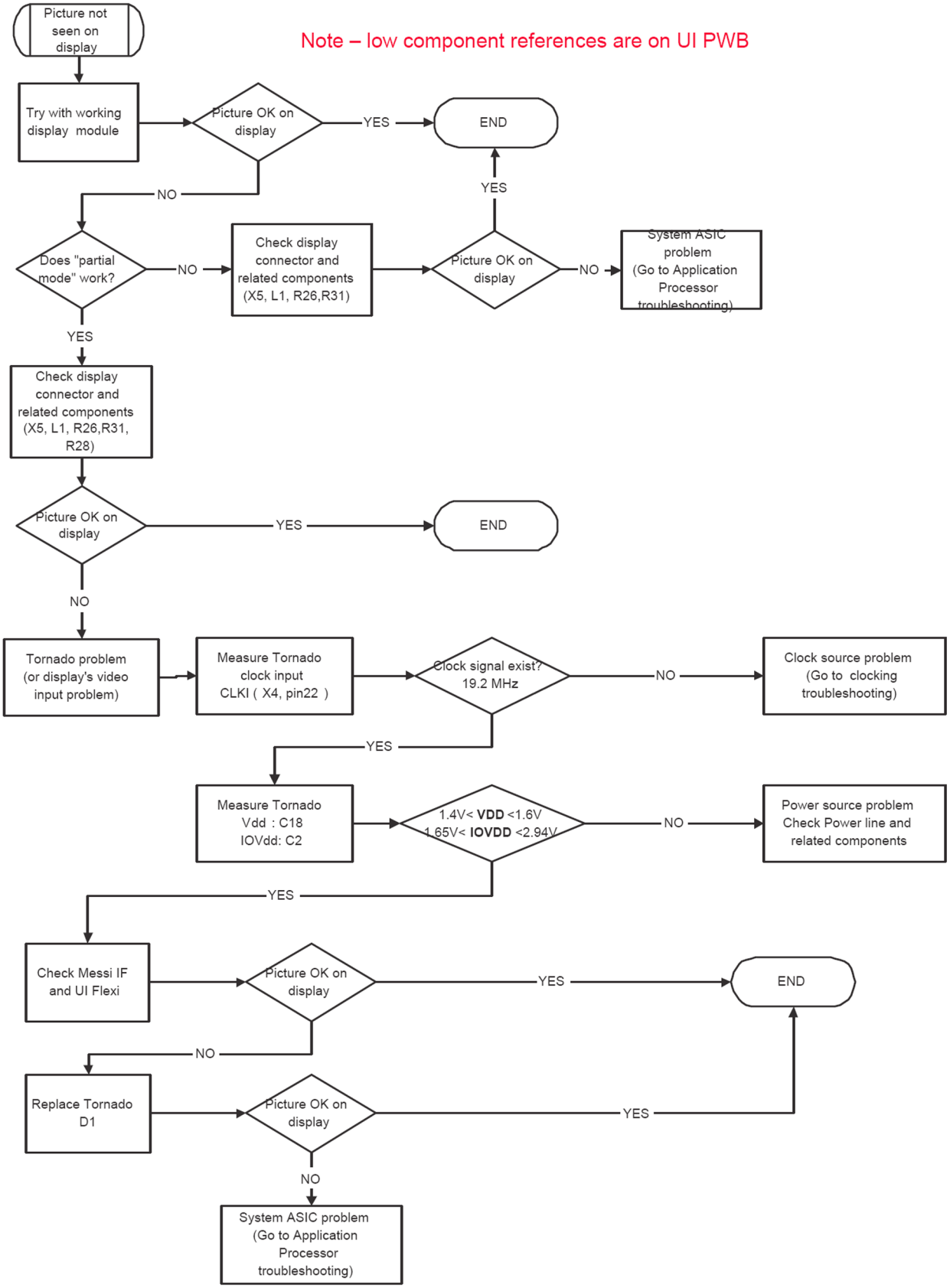
Display controller troubleshooting

Troubleshooting flow



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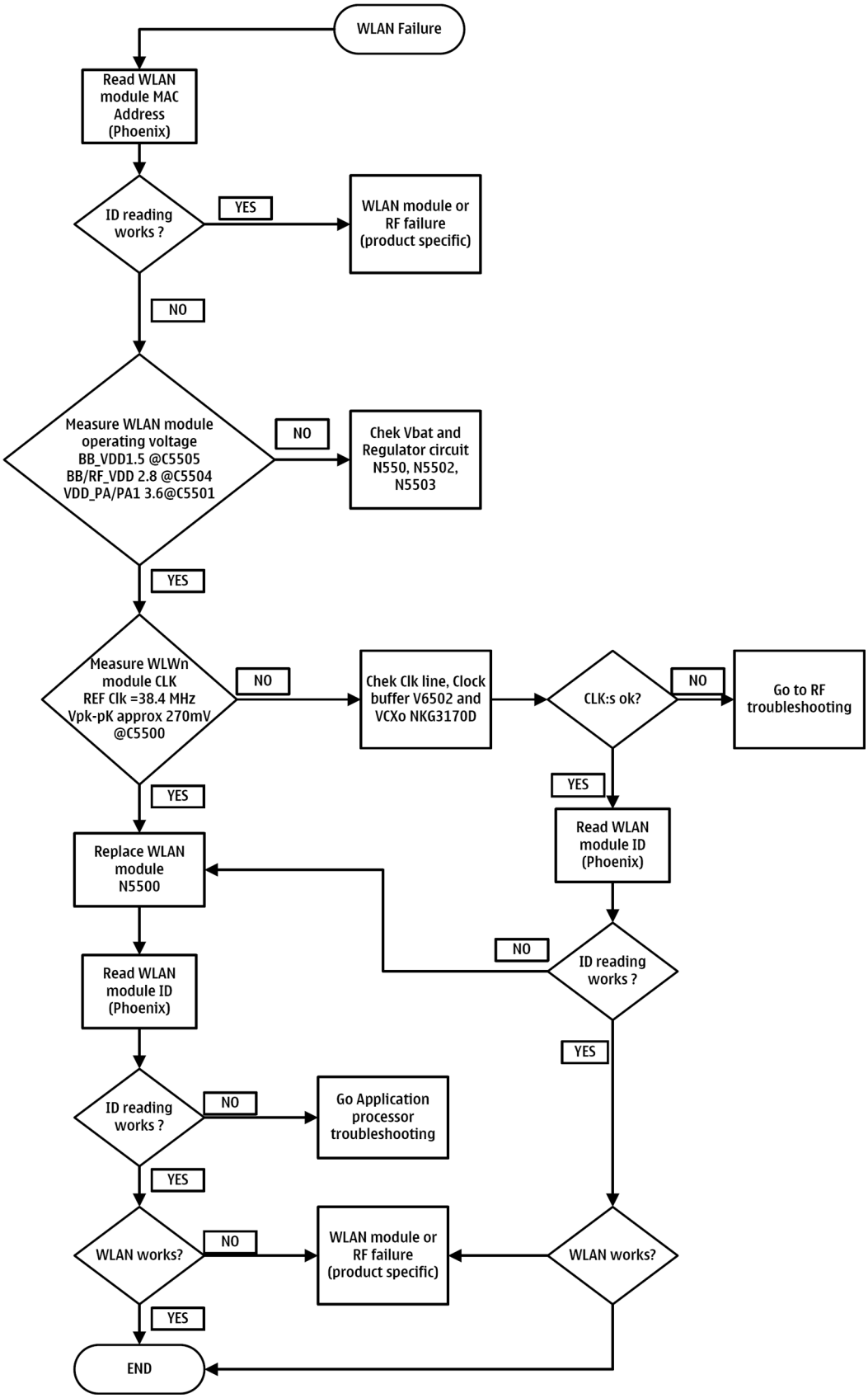
WLAN interface troubleshooting

Troubleshooting flow



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Keyboard troubleshooting

Context

There are two possible failure modes in the keyboard module:

- One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, corrosion).
- Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection). For a more detailed description of the keyboard and keymatrix, see section **Keyboard**.

If the failure mode is not clear, start with the **Keyboard Test** in *Phoenix*.

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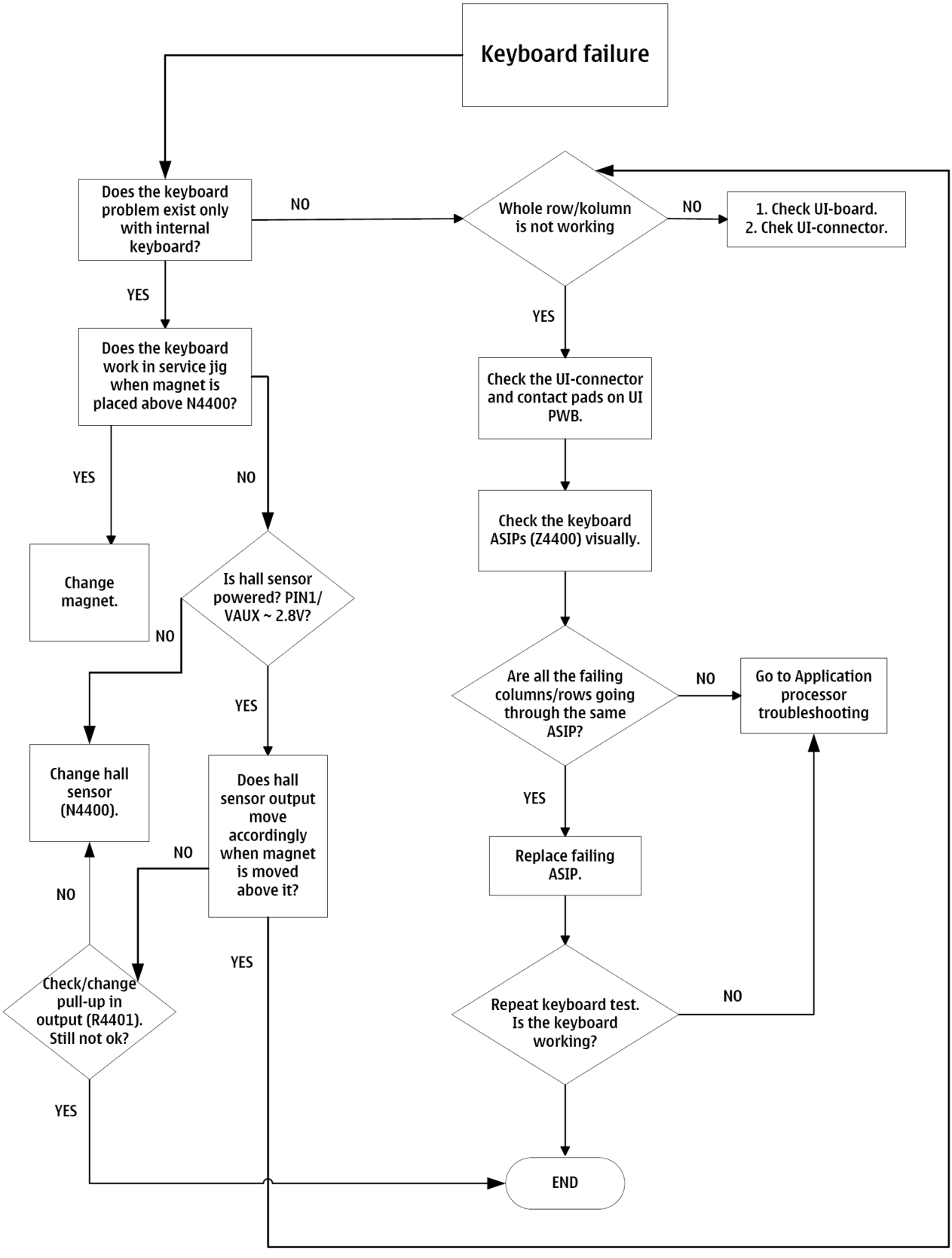
Troubleshooting flow



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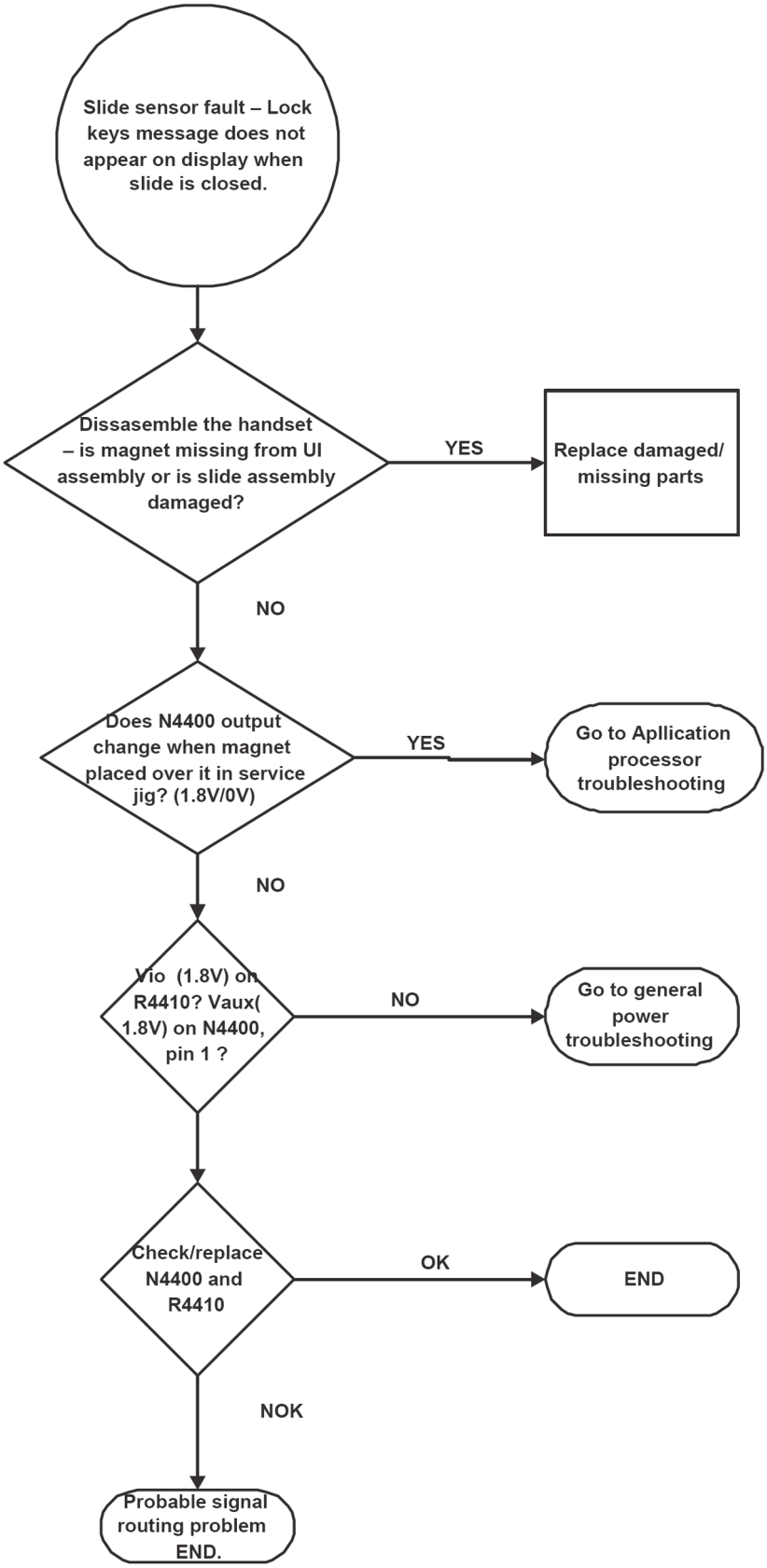
Slider switch troubleshooting

Troubleshooting flow



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FM radio troubleshooting

Context

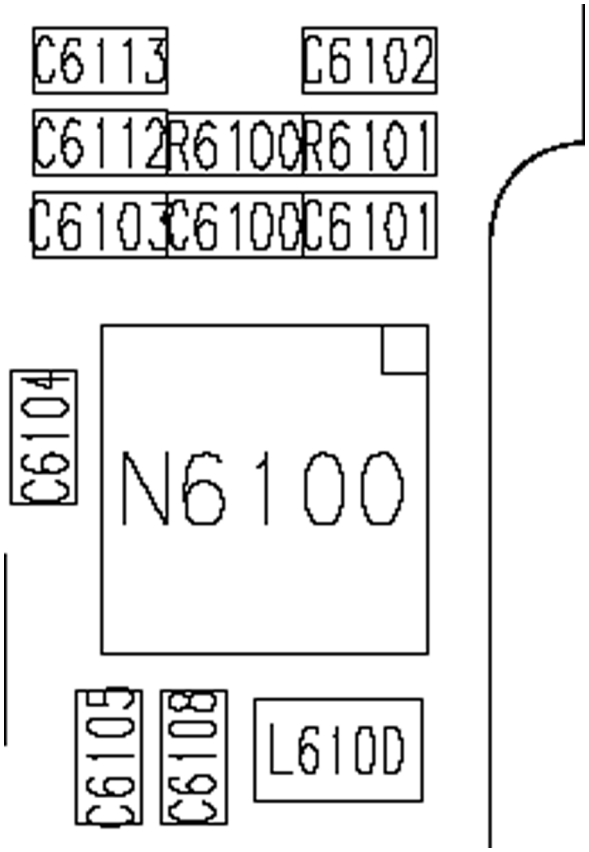

Figure 47 FM radio placement 1

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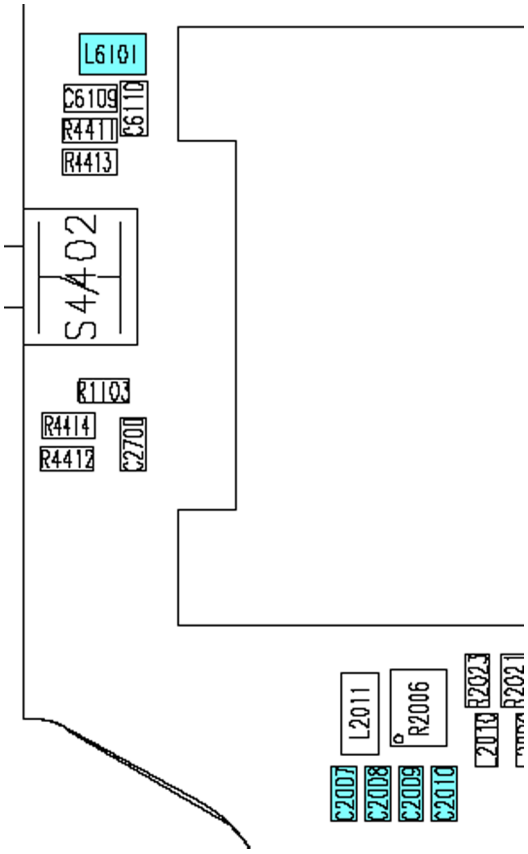

Figure 48 FM radio placement 2

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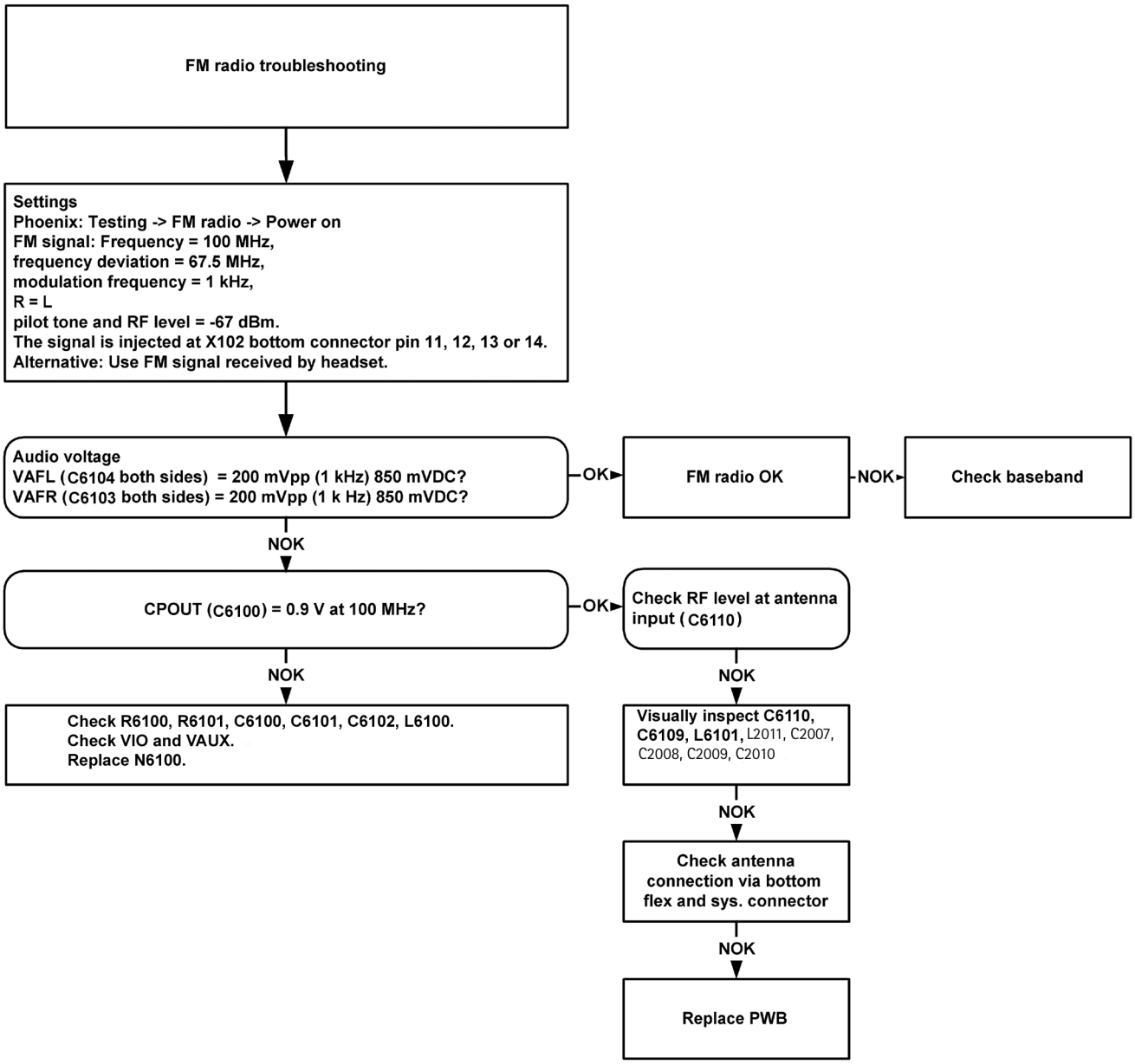
Troubleshooting flow



Certificate restoring for BB5.0 products

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-8 or FPS-10.

  Note: USB flashing does not work for a dead BB5.0 phone.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:

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- APAC: sydney.service@nokia.com
- CHINA: repair.ams@nokia.com
- E&A: salo.repair@nokia.com
- AMERICAS: fls1.usa@nokia.com

- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2004.39.7.70 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5.0 testing and tuning features)
- External smart card reader

  Note: The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.
   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-8 or FPS-10.
   ii Update the phone MCU software to the latest available version.
   If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.
   iii Choose the product manually from **File→Open Product** , and click **OK**.
   Wait for the phone type designator (e.g. “RM-1”) to be displayed in the status bar.
   iv Go to **Flashing→SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.

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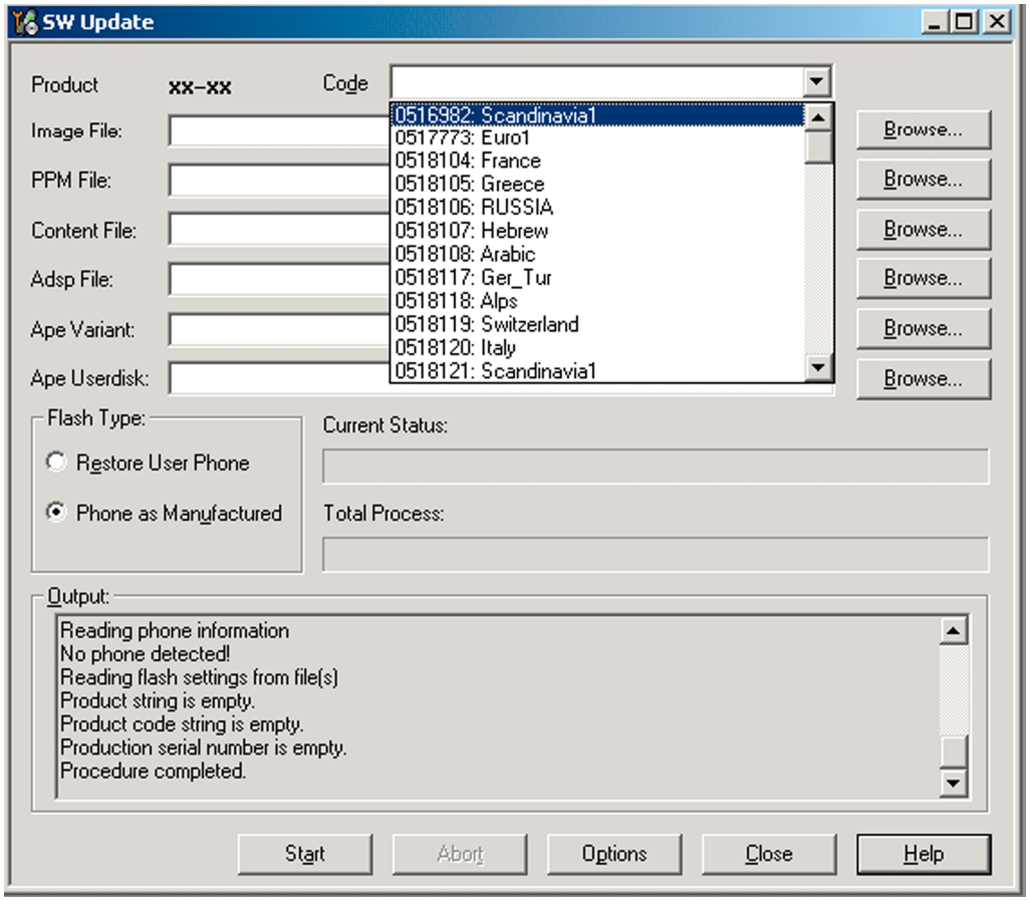

Product	is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically.
Code	must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.
Flash Type	must be set to **Phone as Manufactured**.

v To continue, click **Start**.

Progress bars and messages on the screen show actions during phone programming, please wait.

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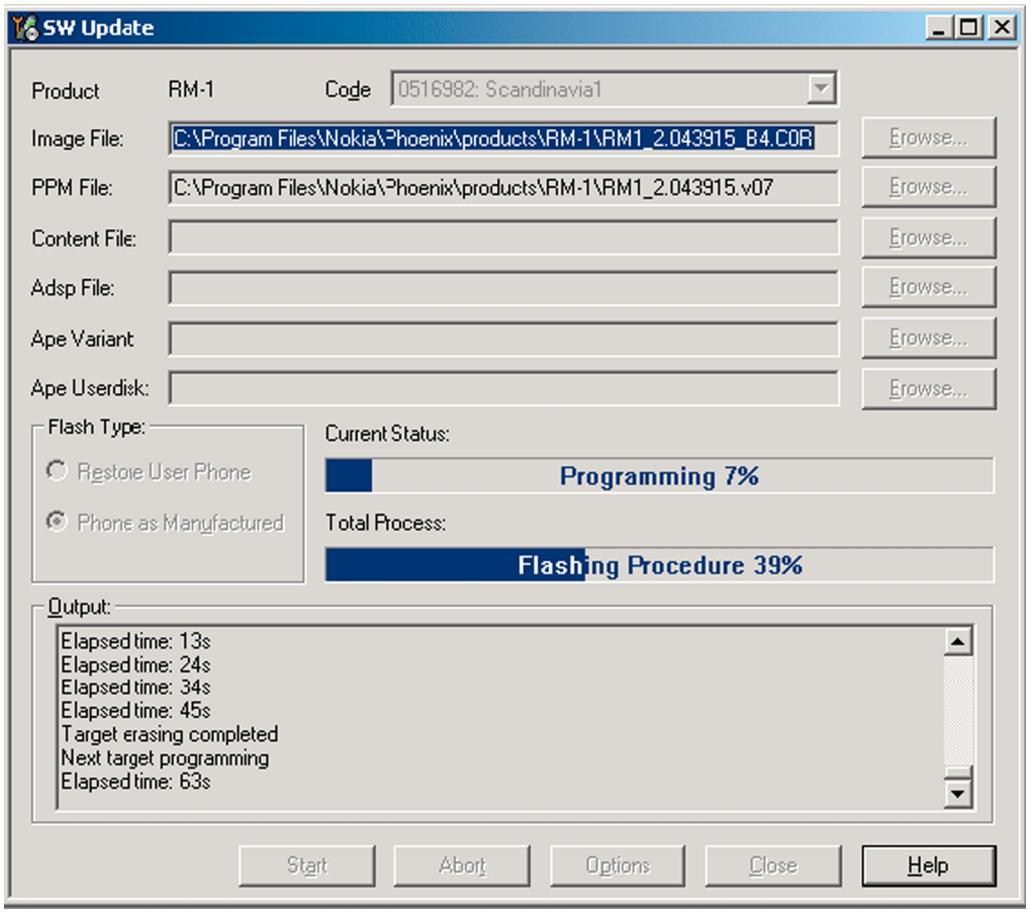


Programming is completed when *Flashing Completed* message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *SW Update* window and then choose **File→Close Product** .

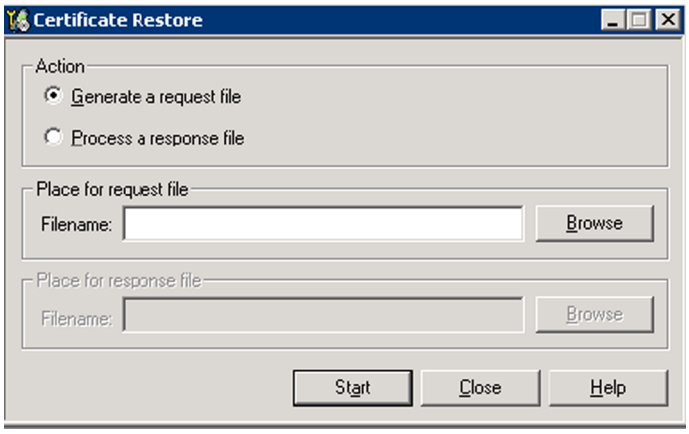
2. Create a *Request* file.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

i To connect the phone with *Phoenix*, choose **File→Scan Product** .

ii Choose **Tools→Certificate Restore** .

iii To choose a location for the request file, click **Browse**.



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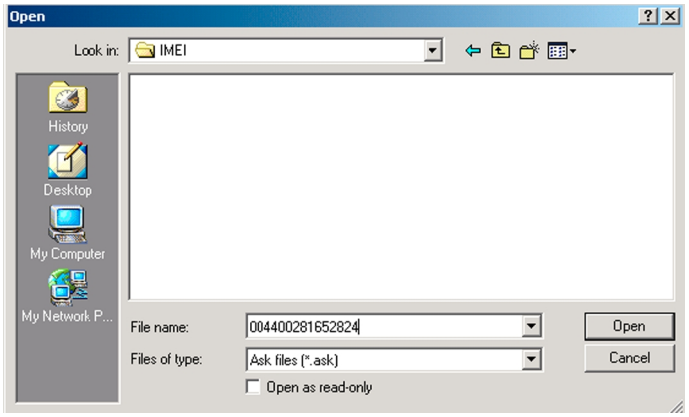
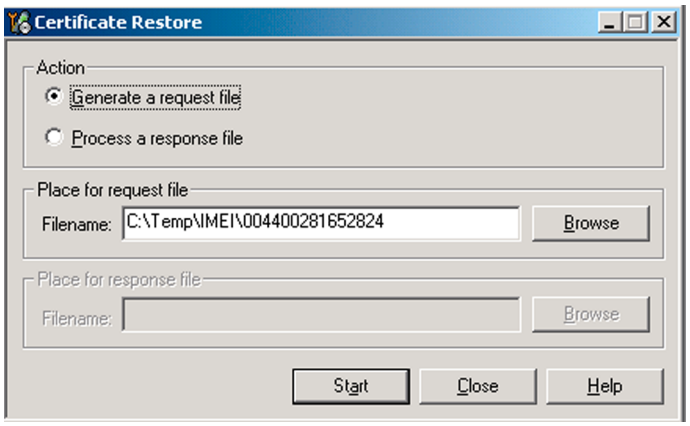
iv Name the file so that you can easily identify it, and click **Open**.



The name of the file and its location are shown.



v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

i Save the reply file sent by Nokia to your computer.

ii Start *Phoenix* service software.

iii Choose **File→Scan Product** .

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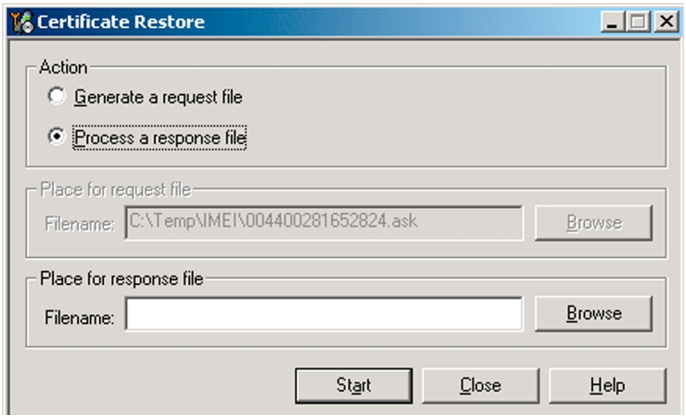
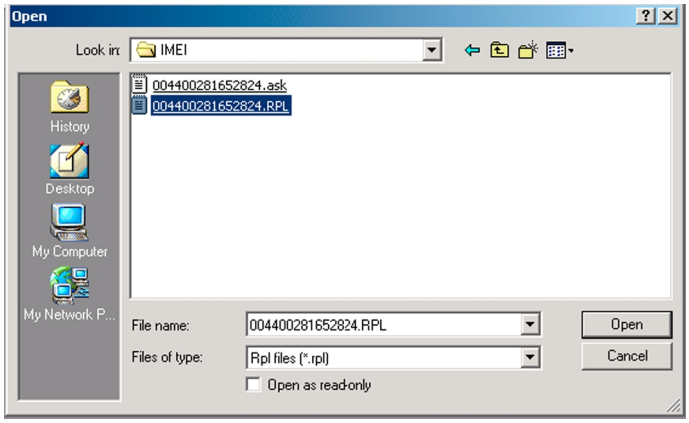
iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.



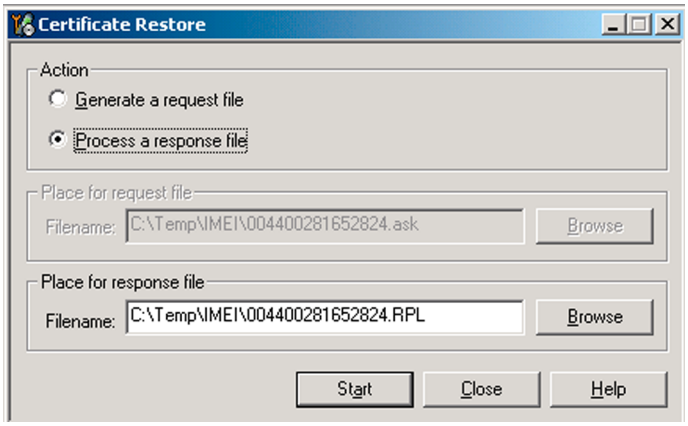
v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.



The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.



Next action

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

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Display module troubleshooting

General instructions for display troubleshooting

The first step is to verify with a working display that the fault is not on the display module itself. The display module cannot be repaired.

The second step is to check that the cellular engine is working normally. This can be done by connecting the phone to a docking station and starting Phoenix service software. With the help of Phoenix read the phone information to check that also application engine is functioning normally (you should be able to read the APE ID).

After these checks proceed to the display troubleshooting flowcharts. Use the Display Test tool in Phoenix to find the detailed fault mode.

Operating modes of the display

Display is in a normal mode when the phone is in active use.

Display is in a partial idle mode when the phone is in the screen saver mode.

Display is in OFF mode when the phone is in the full idle mode (idle LED is flashing).

The operating modes of the display can be controlled with the help of Phoenix.

Table 8 Display module troubleshooting cases

Display blank	There is no image on the display and Idle LED does not flash. Display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or part of the image can be missing. If part of image is missing change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. Backlight is also controlled automatically by the ambient light sensor. This means that in case the display is working (image OK) but the backlight is not, follow the Display and keyboard backlight troubleshooting..
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the table below.

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Table 9 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Note: Blinking pixels are not allowed in normal operating temperatures and light conditions.

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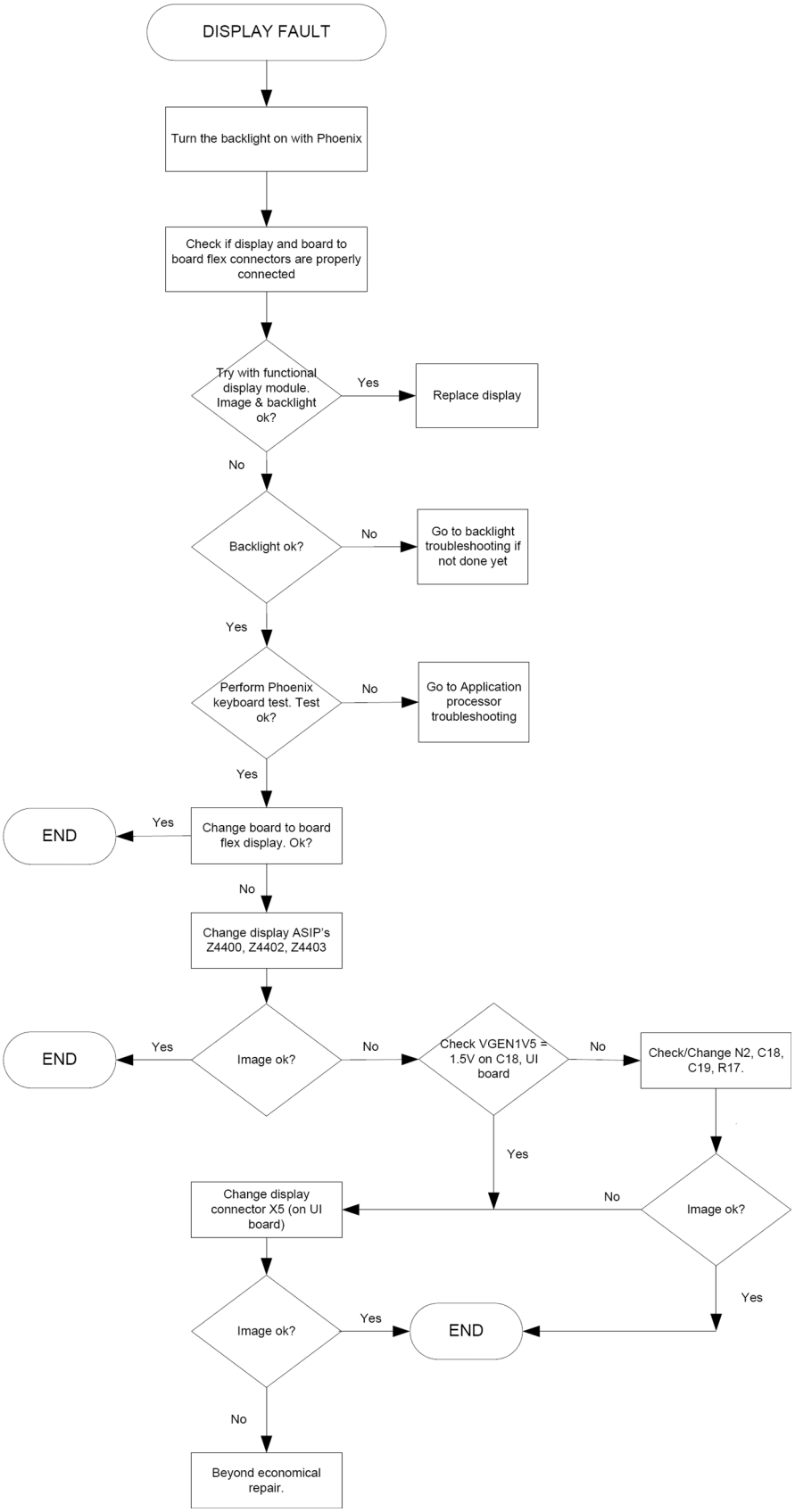
Display fault troubleshooting

Troubleshooting flow



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Display and keyboard backlight troubleshooting

Context

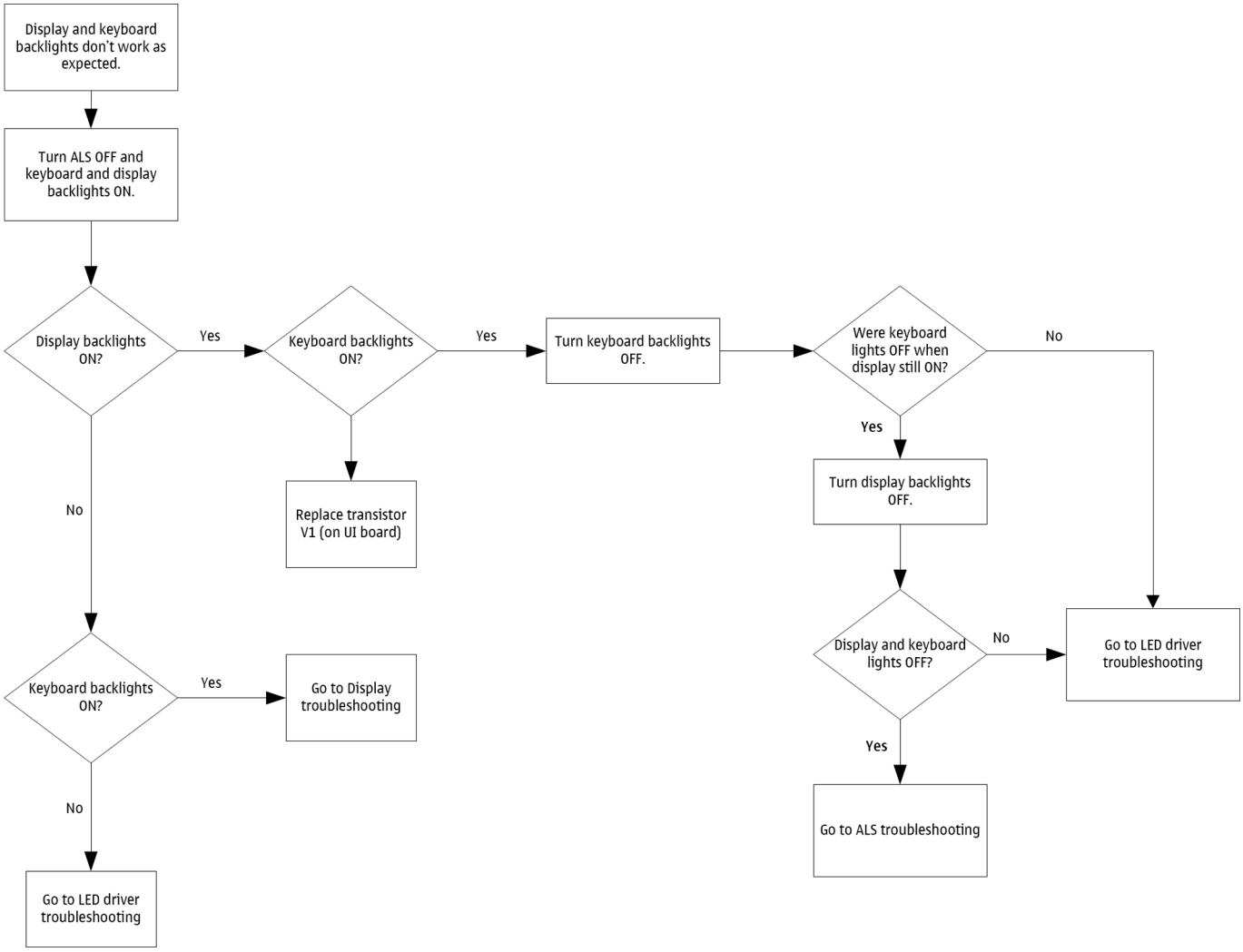
The device has one LED driver that provides current for both display and keyboard backlights.

Keyboard backlights are turned ON only in dark conditions. This is controlled by the Ambient Light Sensor (ALS). Also the brightness of the display is adjusted by the ambient light sensor.

You can enable/disable ALS with the help of Phoenix service software.

Display brightness can be adjusted manually, if ALS is disabled. If the ambient light sensor is enabled, it adjusts the display brightness automatically.

Troubleshooting flow



ALS troubleshooting

Context

- If a phototransistor is broken, replace it with a typical phototransistor.
- If the phototransistor is changed, the calibration value in the phone memory has to be changed to the default value '1'.

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- Make sure that you have completed Display and keypad backlight troubleshooting first before starting ALS troubleshooting.

Here are some hints for ALS troubleshooting; the following troubleshooting diagram refers to these:

- Phoenix LED control tool also shows you luminance. The correct luminance in darkness is <20lx, and in office environment 100-2000lx. The luminance value depends strongly on the light source and the angle of the phone, so these values are only a rough guideline.
- LED driver control voltage measurement points can be found from LED driver troubleshooting section. When backlight brightness is set to 100%, both GENOUT-signals are low, and enable PWM is 100%.
- *Phoenix* has an ambient light sensor calibration tool for changing calibration values. The pull-up resistor calibration is done first:
  a Cover the light guide (upper part of the A Cover).
  b Click **Start Write** .
  c Manually change the ambient light sensor value to the default value. There is no special tool for this, but you have to perform calibration normally and then set the **Co-efficient** result to *1* before writing it to the phone memory.

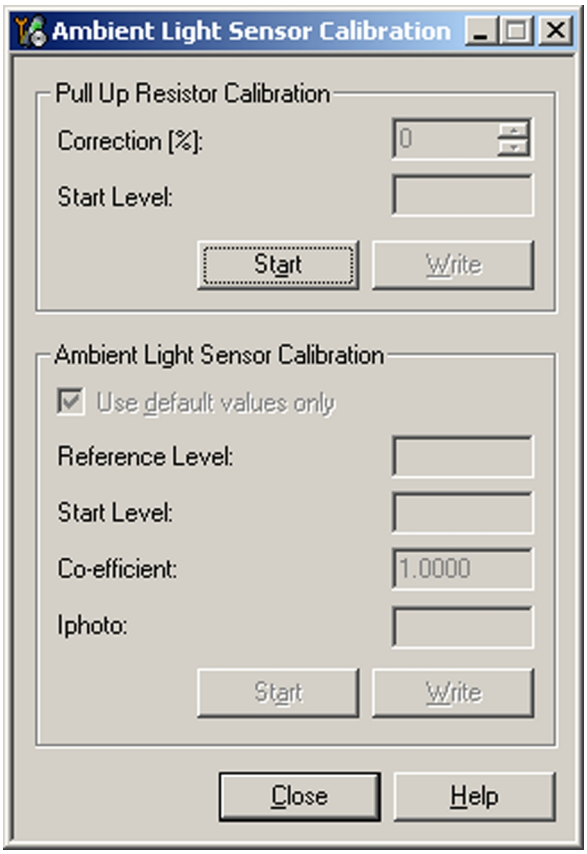

Figure 49 ***Ambient Light Sensor Calibration*** **window**

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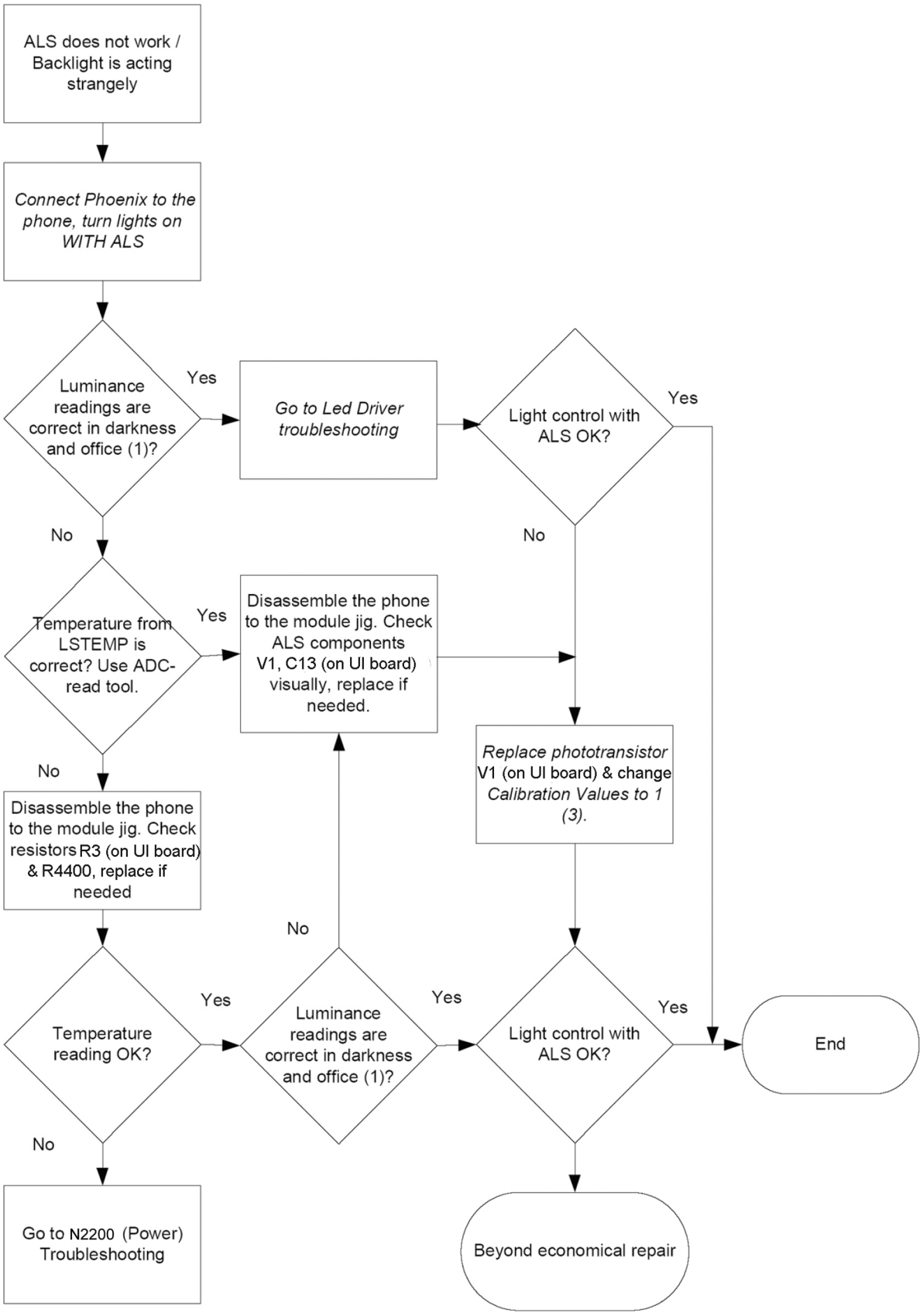
Troubleshooting flow



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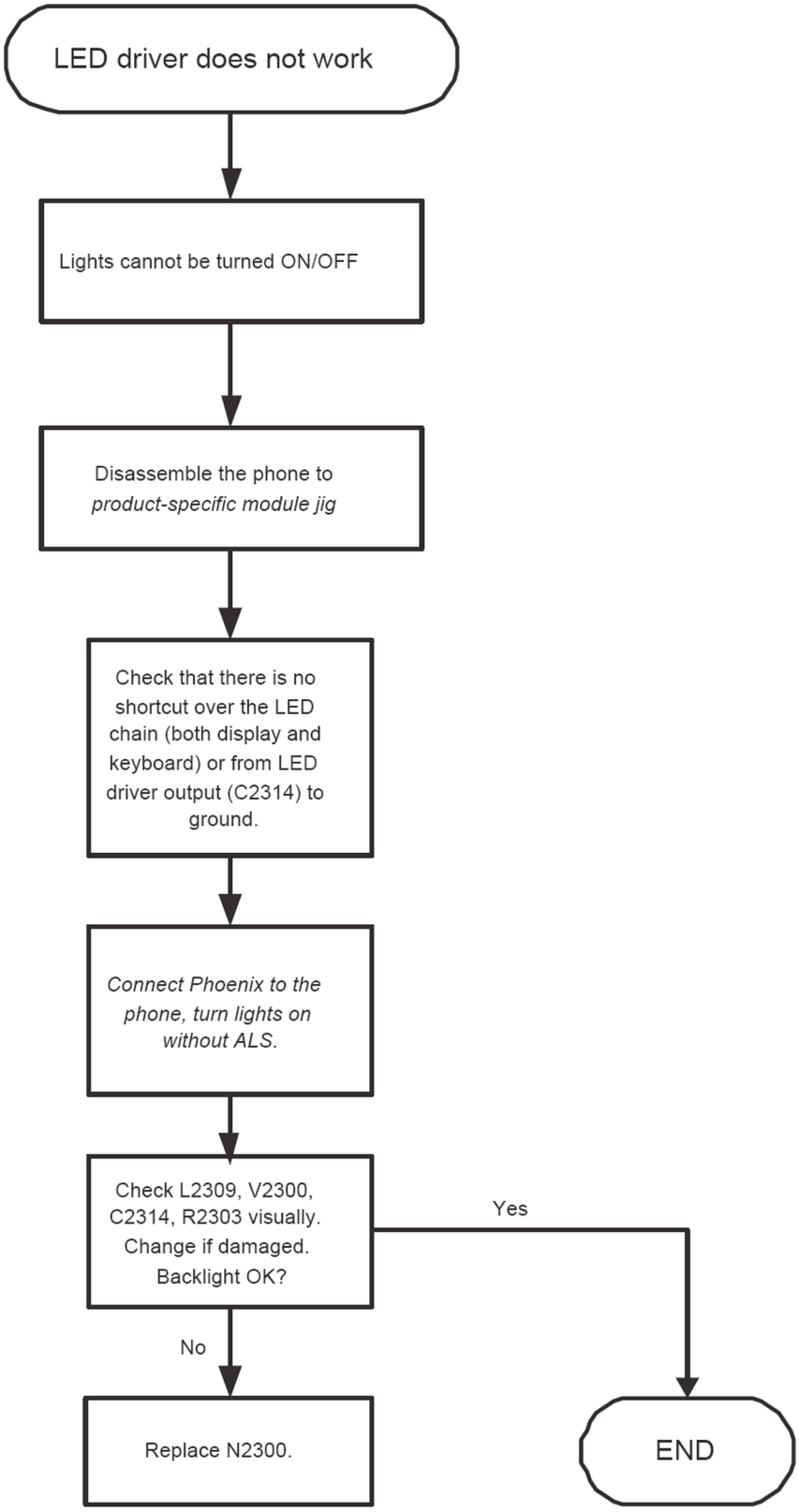
LED driver troubleshooting

Troubleshooting flow



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Bluetooth troubleshooting

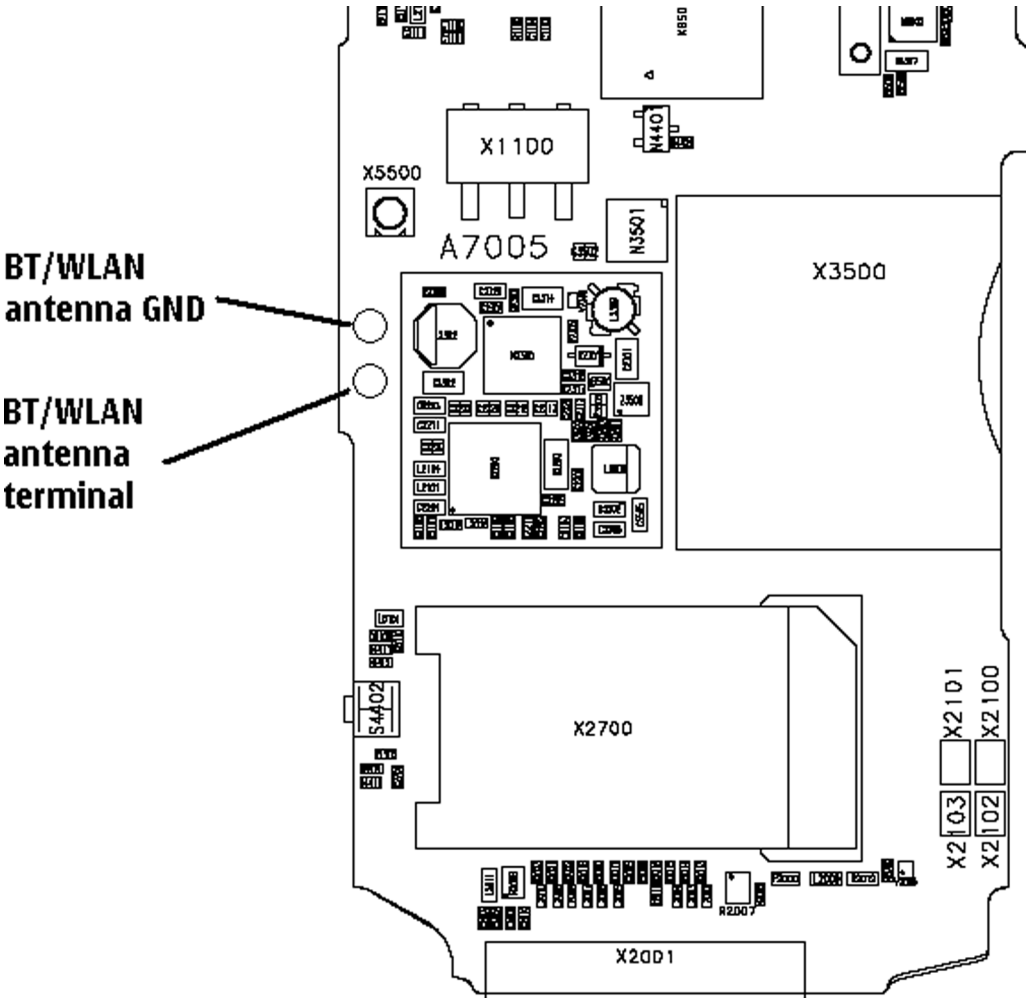
Introduction to Bluetooth troubleshooting

There are two main Bluetooth problems that can occur:

Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB. (see next page for details about BT antenna HW and Mechanics)
A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

Location of the BT antenna



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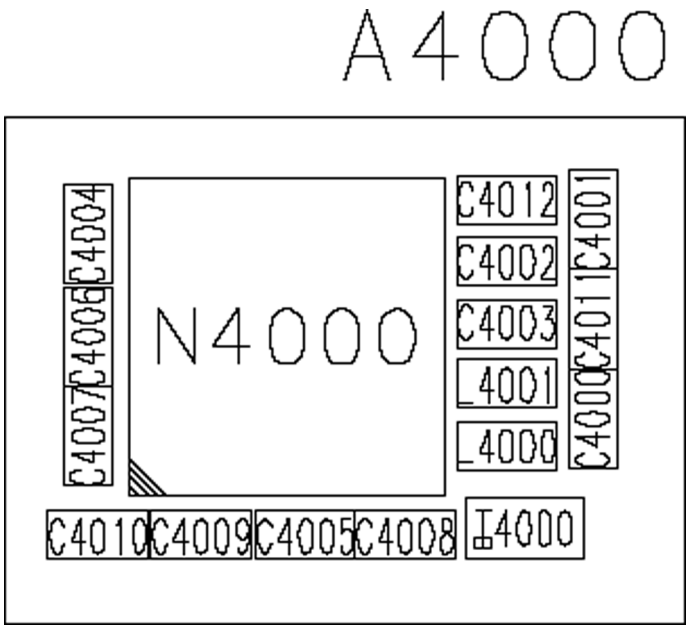
Bluetooth component layout



Bluetooth settings for Phoenix

Steps

1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9.

   In addition to JBT-9, also JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.

   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.

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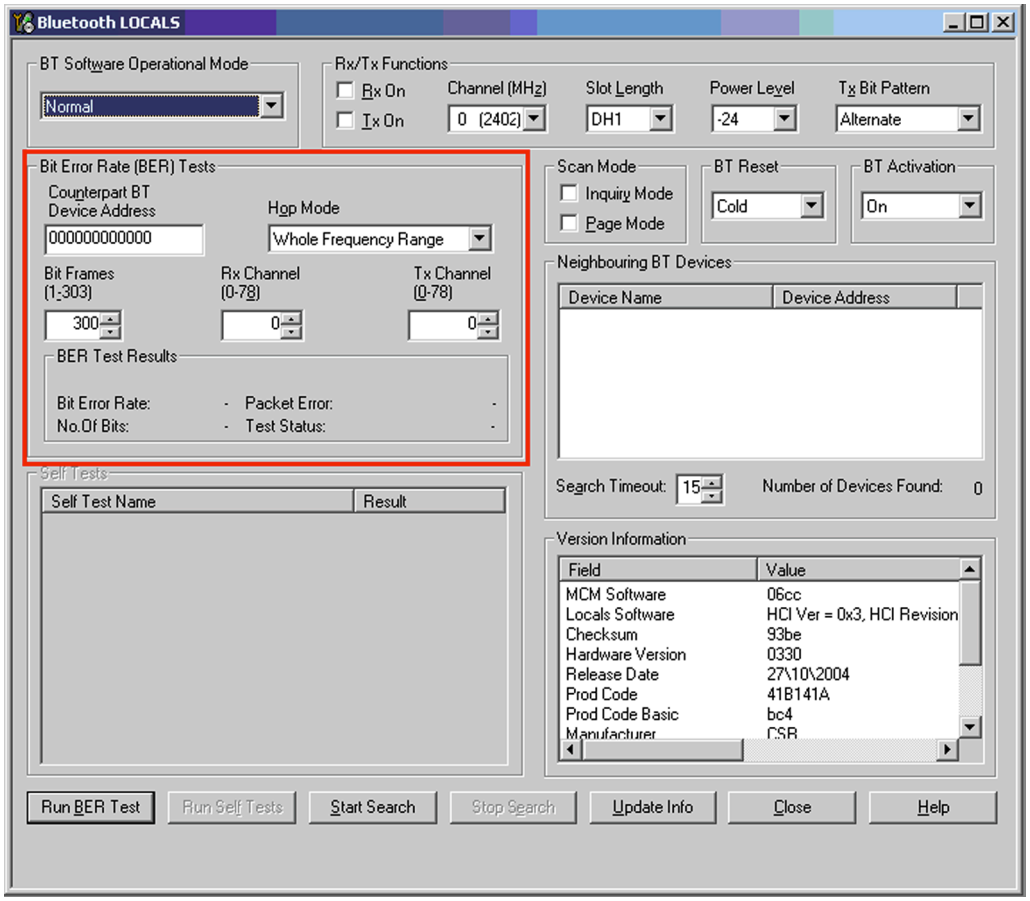

Figure 50 BER test result

Bluetooth self tests in Phoenix

Steps

1. Start *Phoenix* service software.
2. Choose**File→Scan Product.**
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth related tests:
   - **ST_LPRF_IF_TEST**
   - **ST_LPRF_AUDIO_LINES_TEST**
   - **ST_BT_WAKEUP_TEST**

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7. To run the tests, click **Start**.

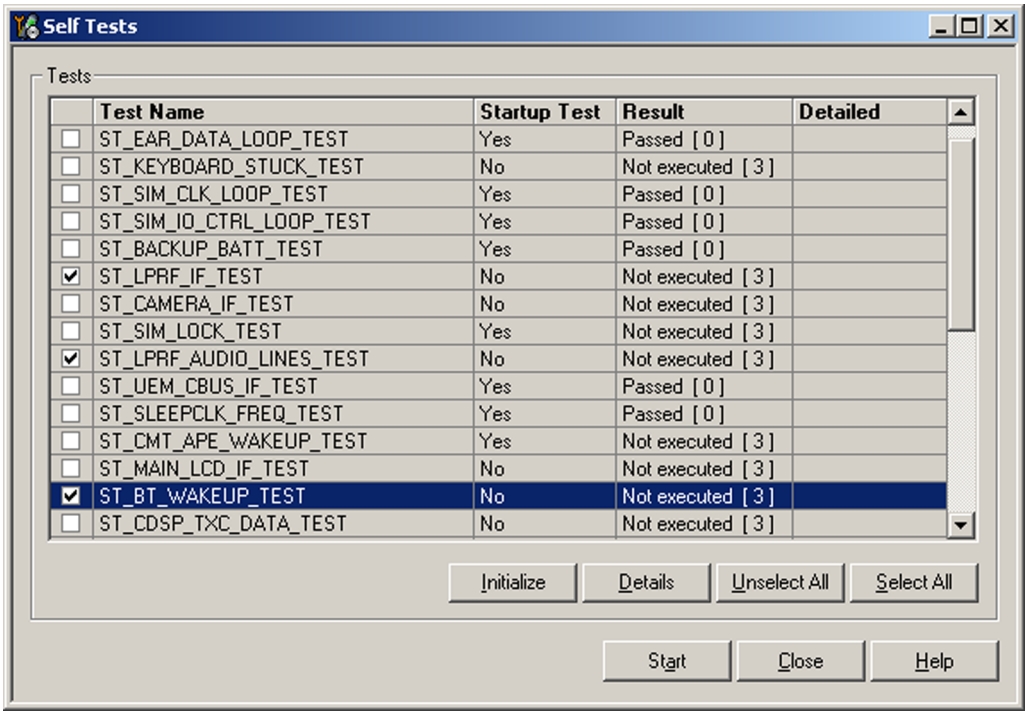

Figure 51 Bluetooth self tests in *Phoenix*

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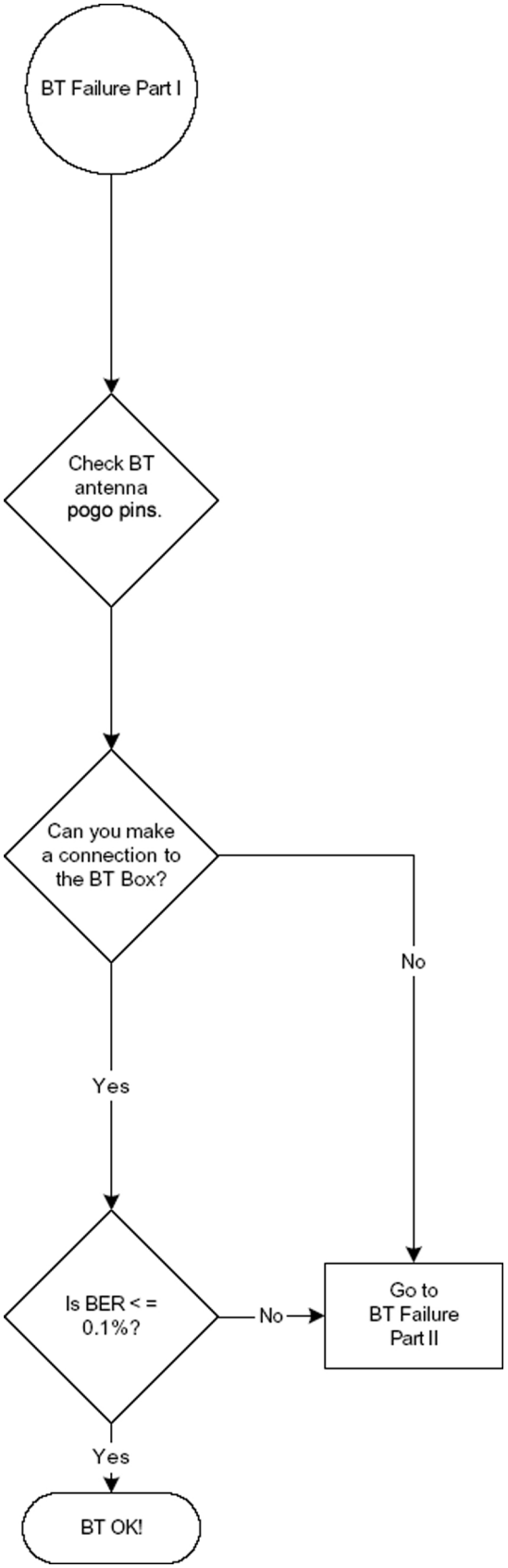
Bluetooth BER failure troubleshooting

Troubleshooting flow



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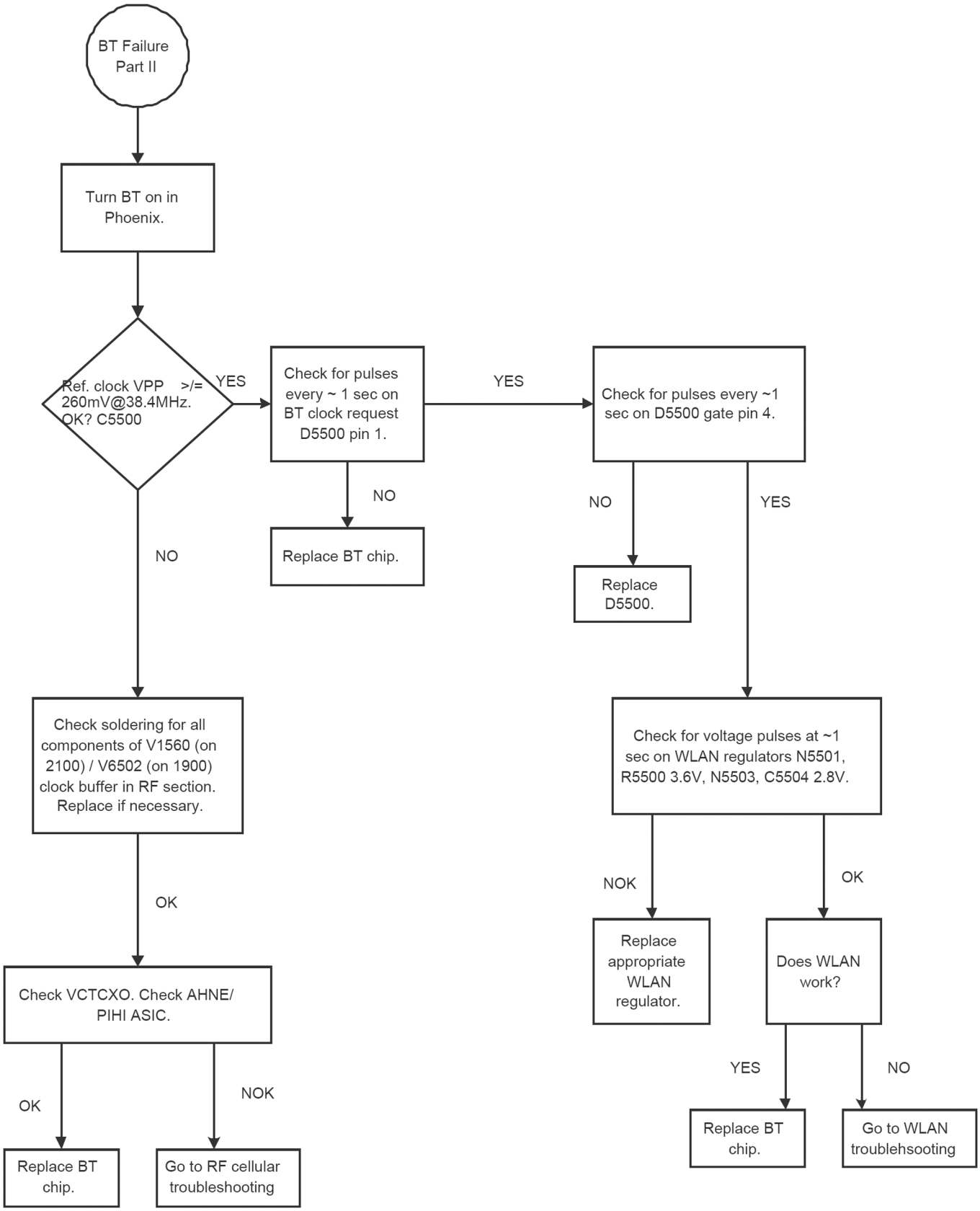

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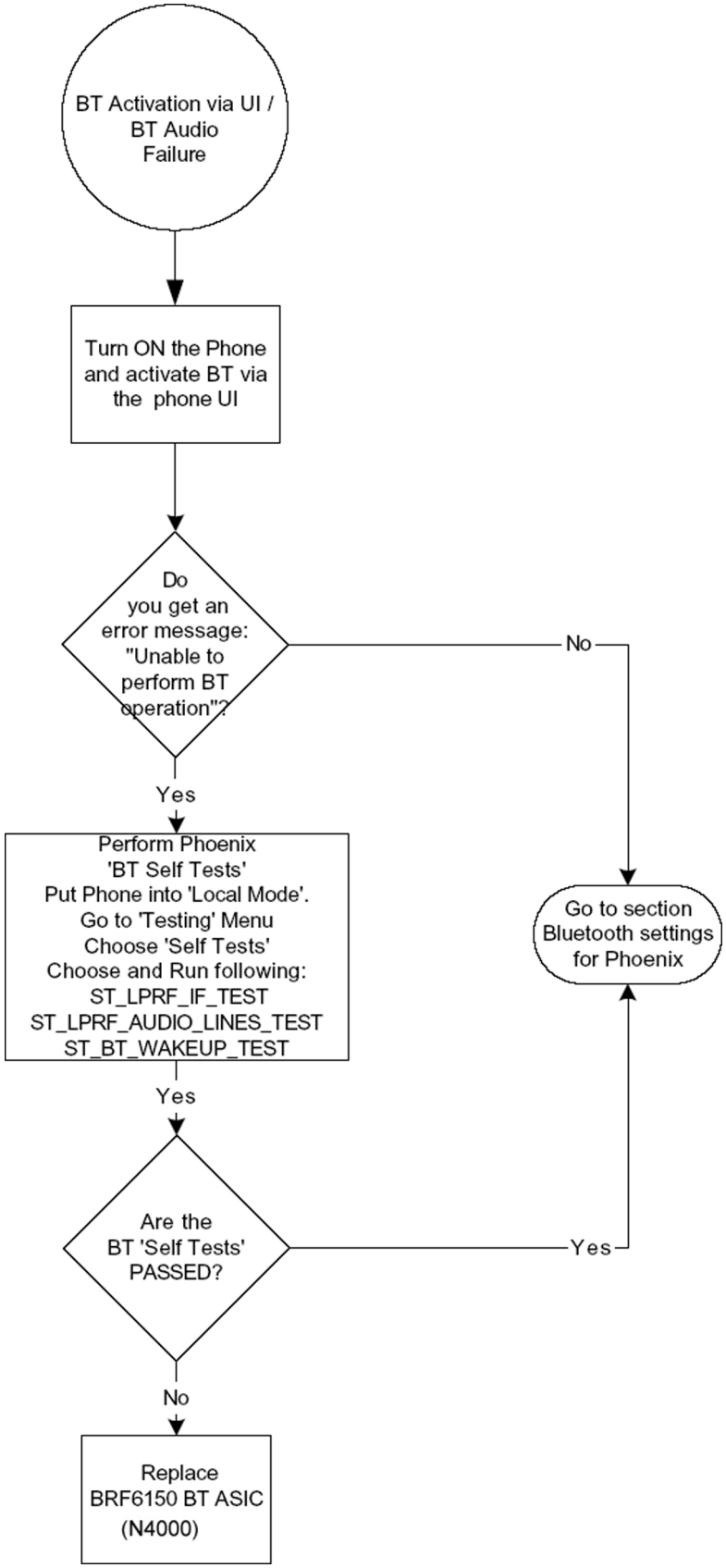
BT audio failure troubleshooting

Troubleshooting flow



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Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree DPMA output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

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Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	X2001 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	X2001 pads					
Internal Mic to External Earpiece	B2100 (OUT/ GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					
		HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

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Measurement data

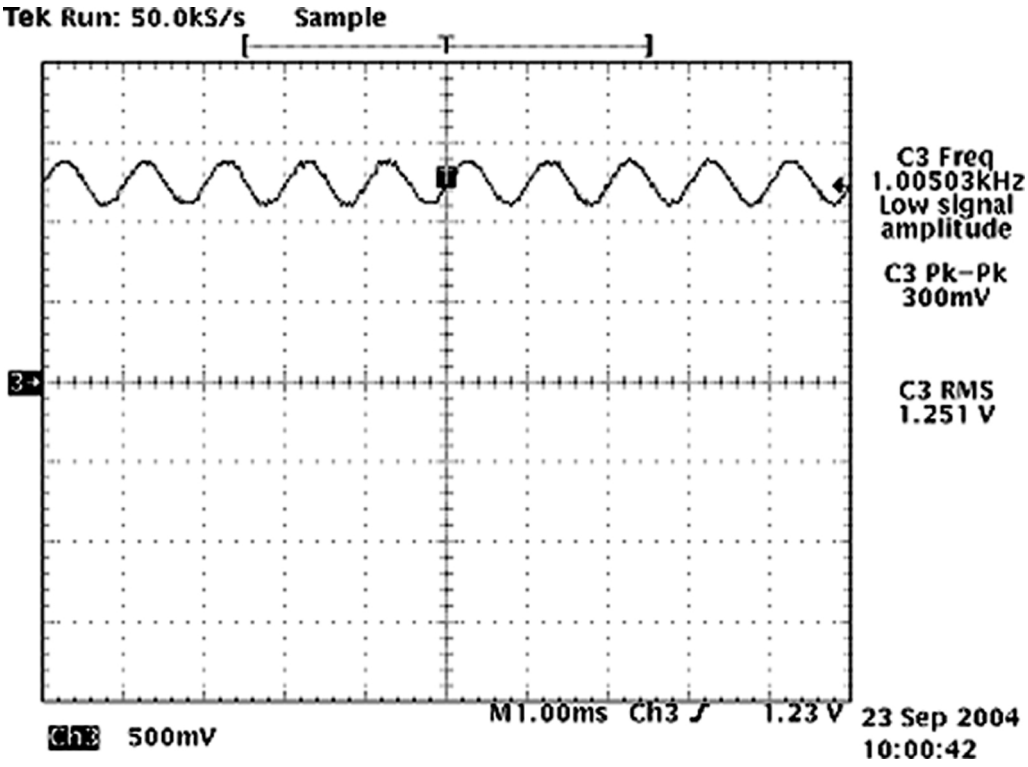
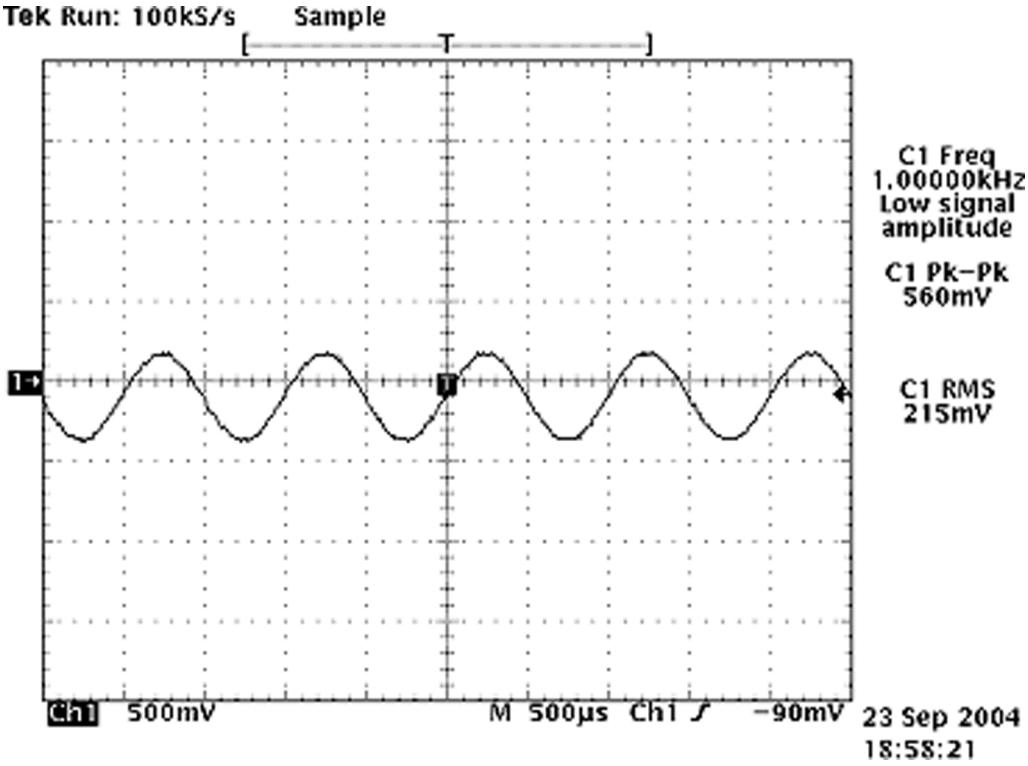


Figure 52 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



If a special low-pass filter designed for measuring digital amplifiers is unavailable, the measurement must be performed with a current probe and the input signal frequency must be 2kHz.

Figure 53 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

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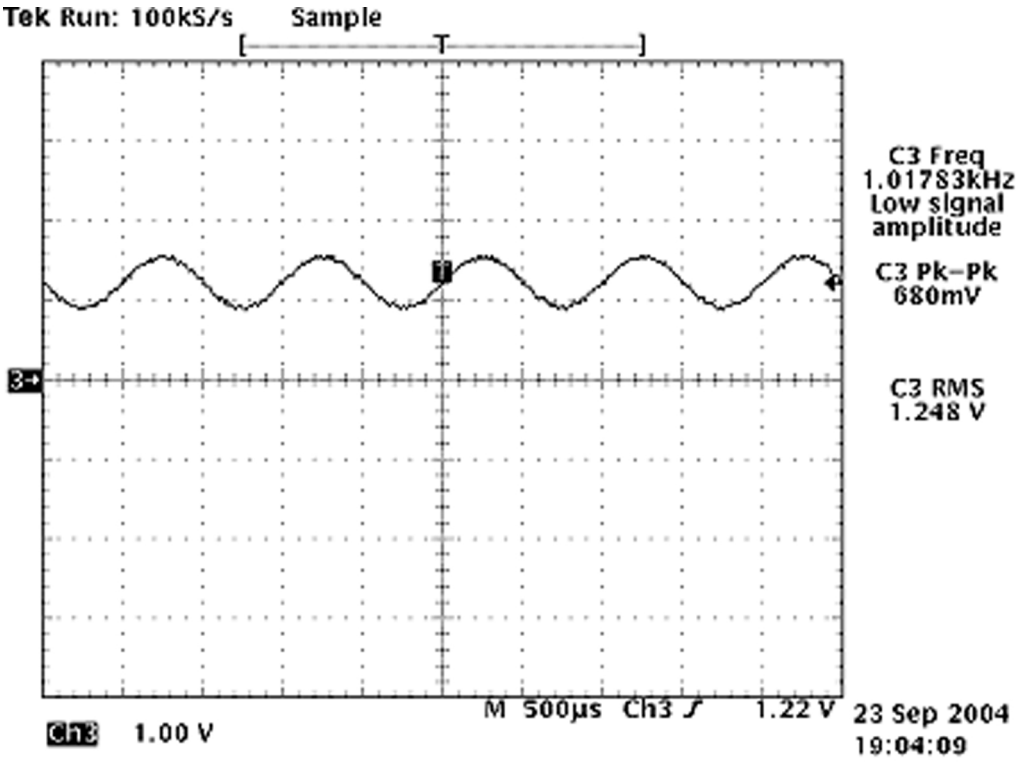

Figure 54 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

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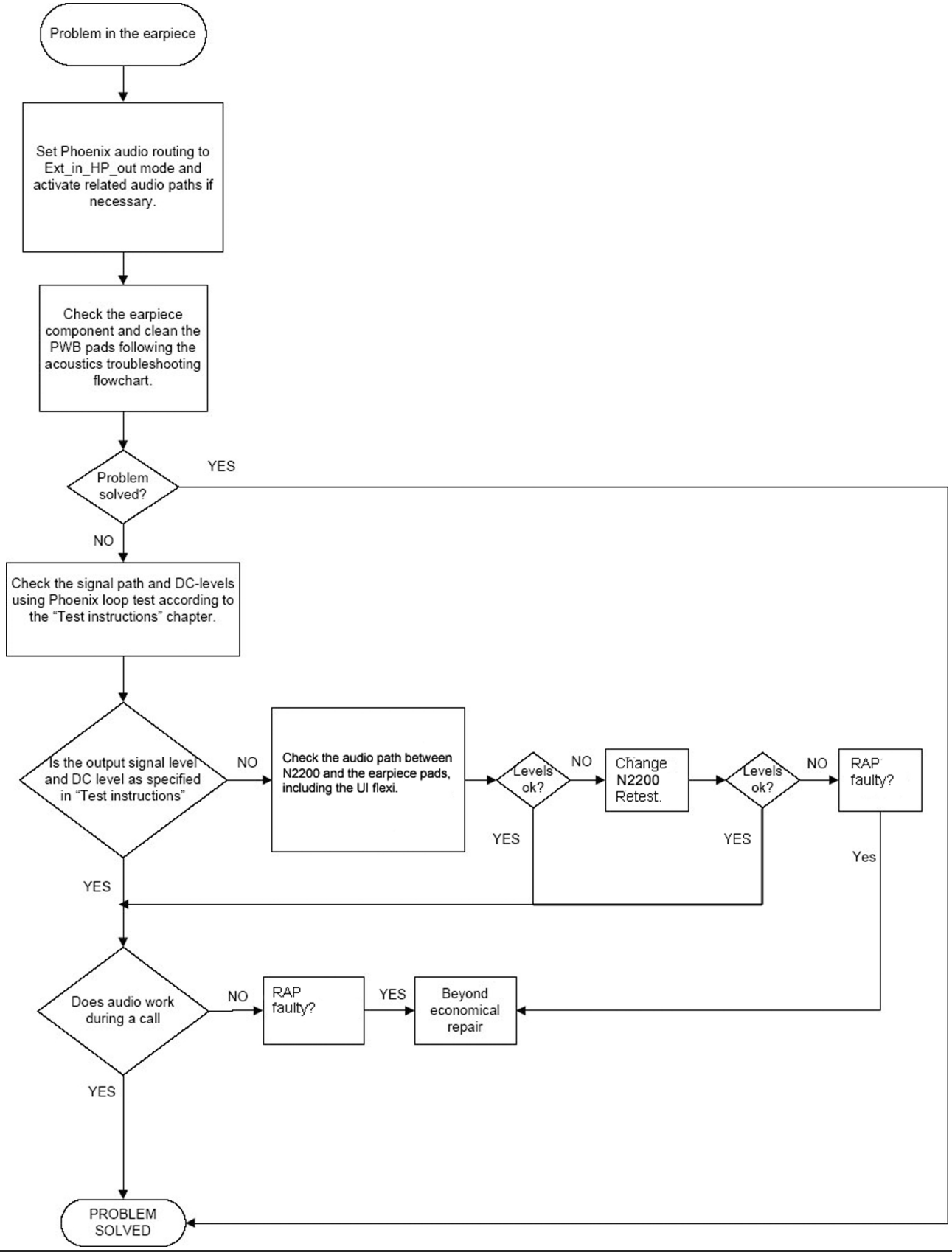
Internal earpiece troubleshooting

Troubleshooting flow



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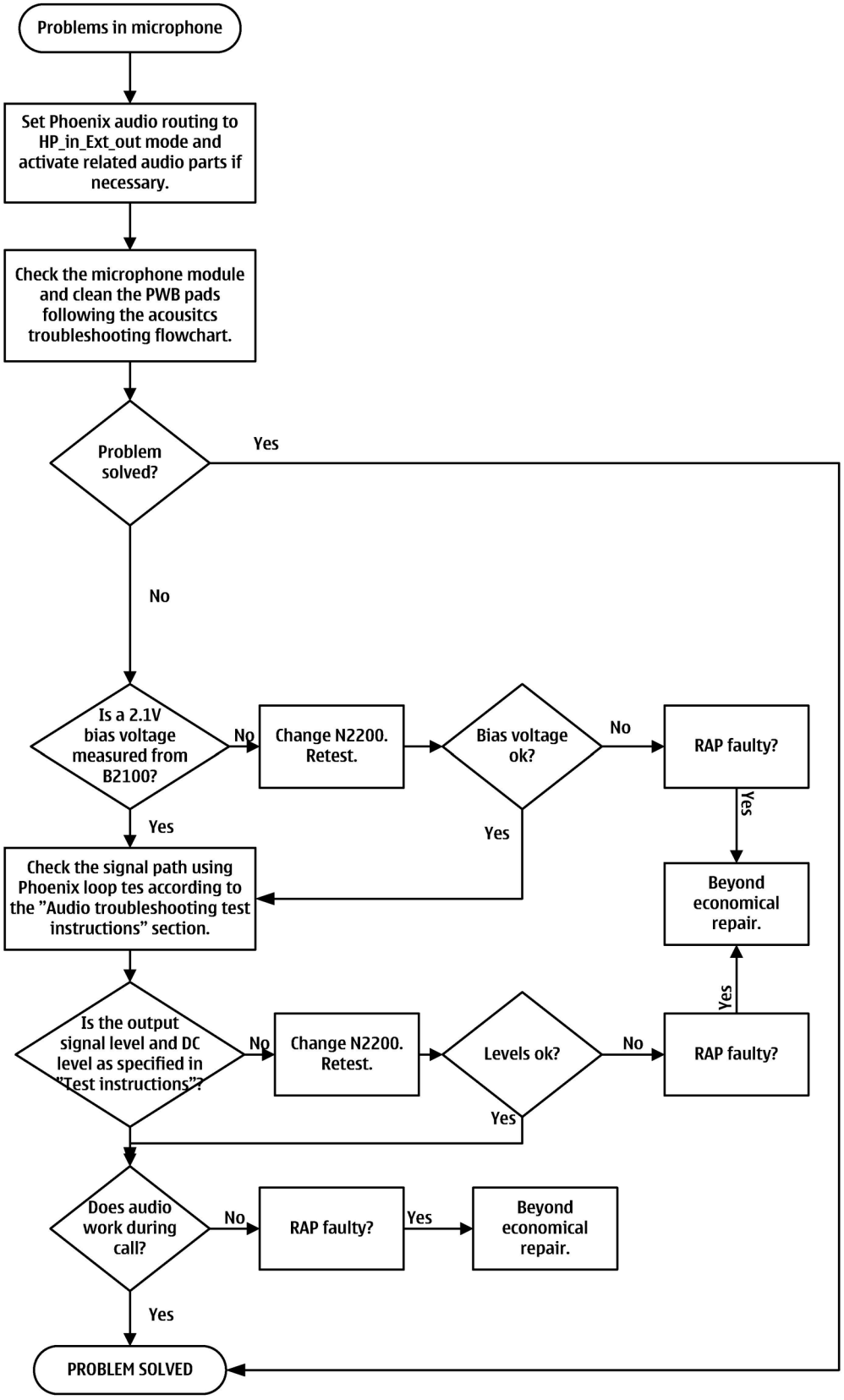
Internal microphone troubleshooting

Troubleshooting flow



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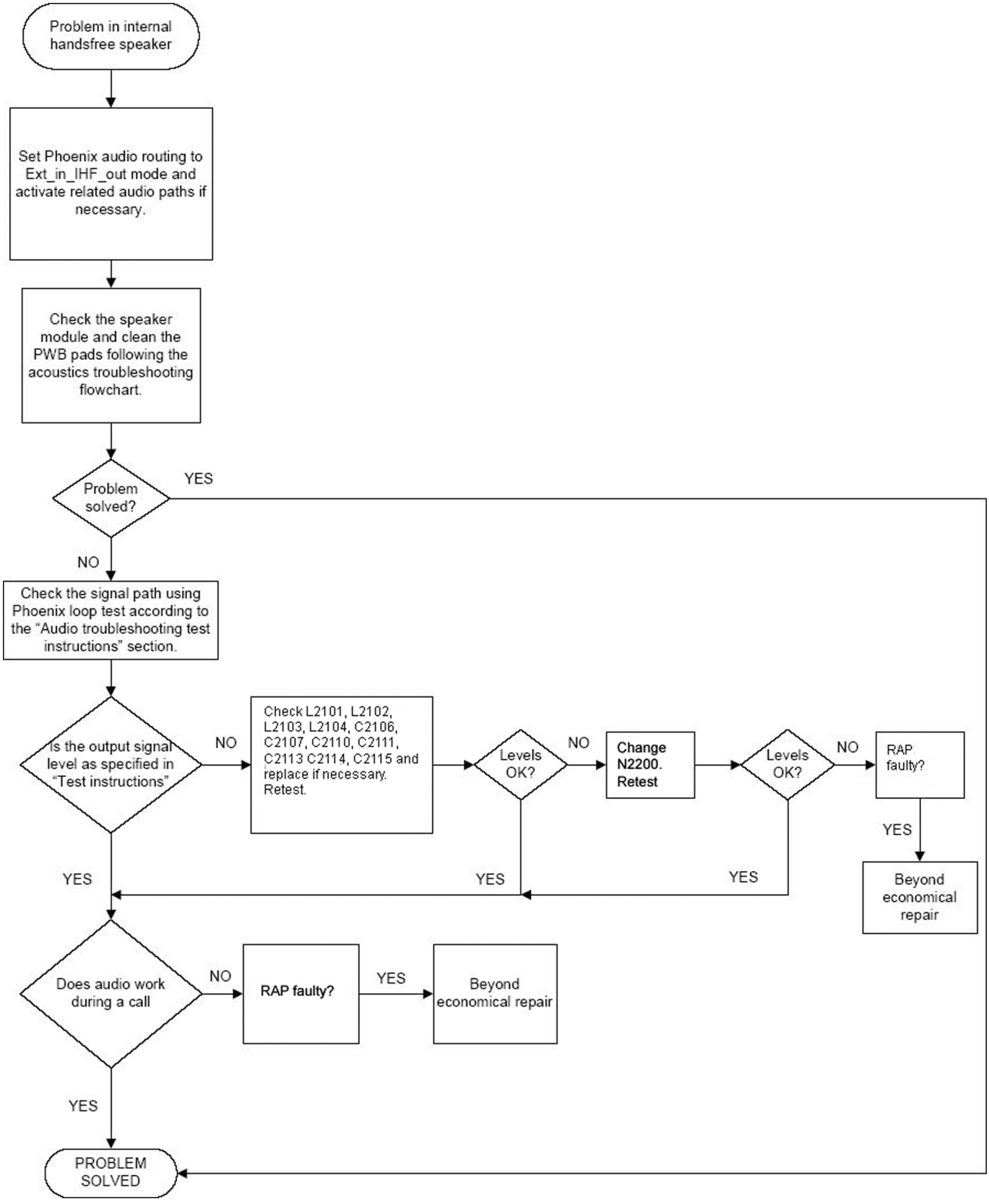
IHF troubleshooting

Troubleshooting flow



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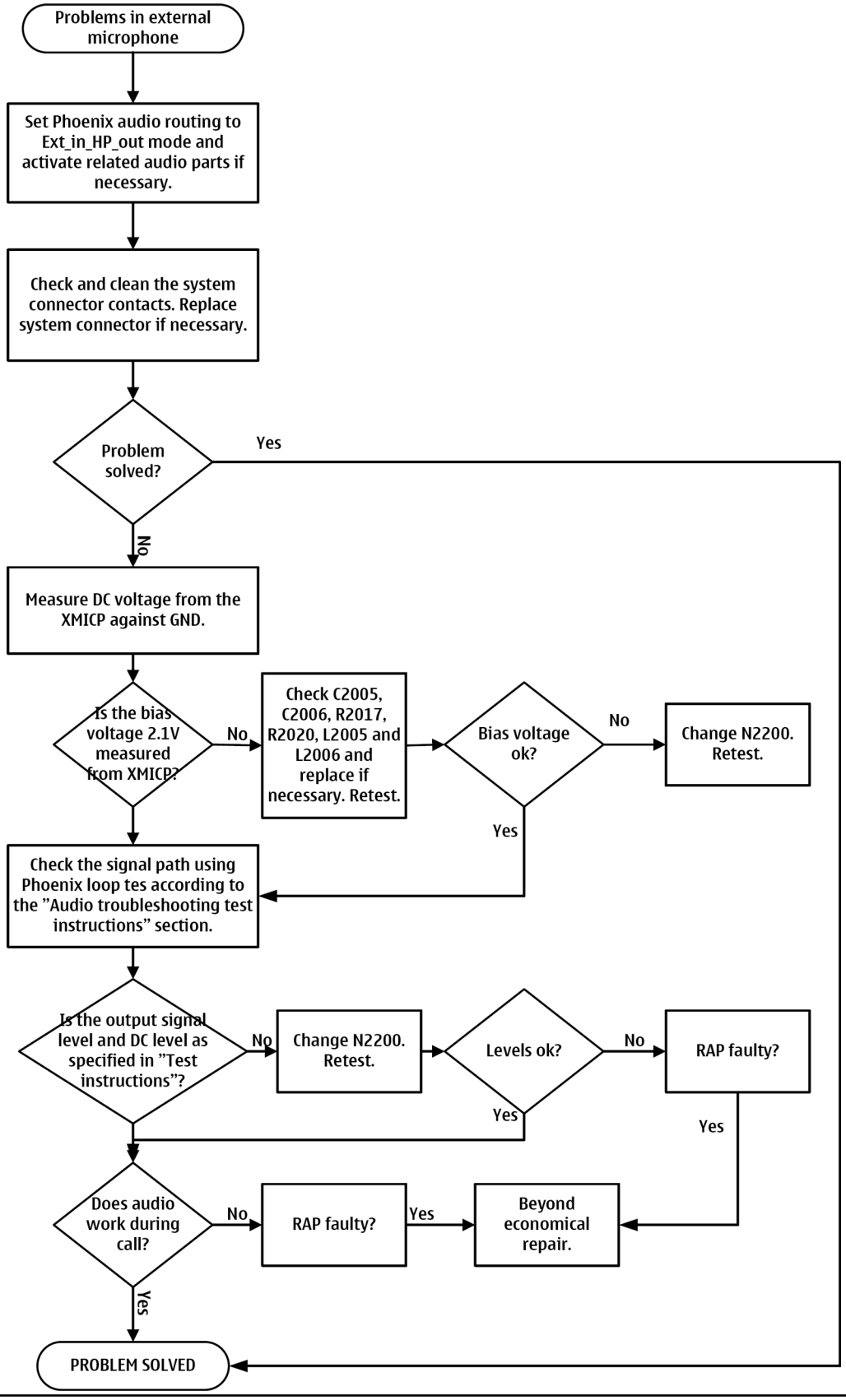
External microphone troubleshooting

Troubleshooting flow



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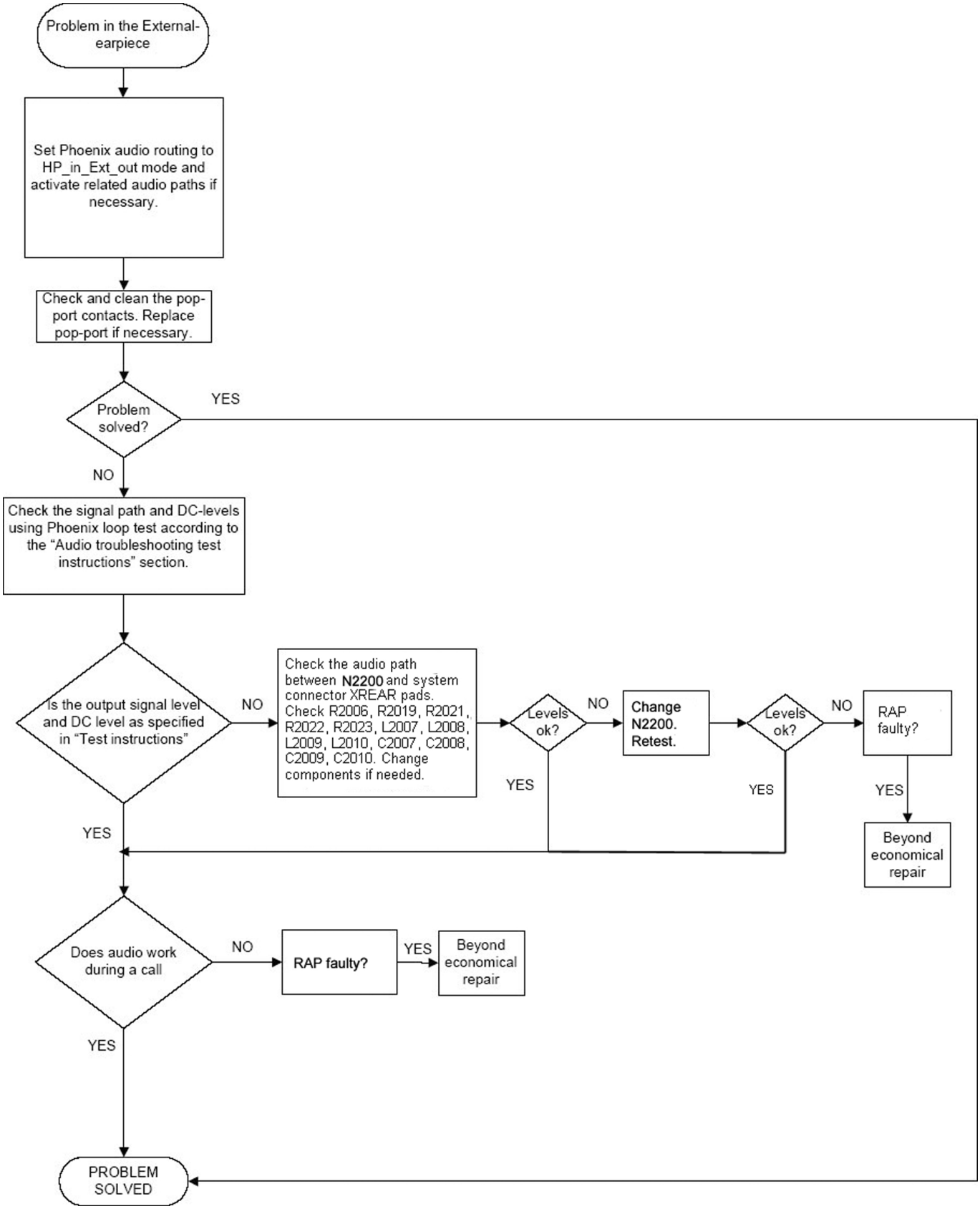
External earpiece troubleshooting

Troubleshooting flow



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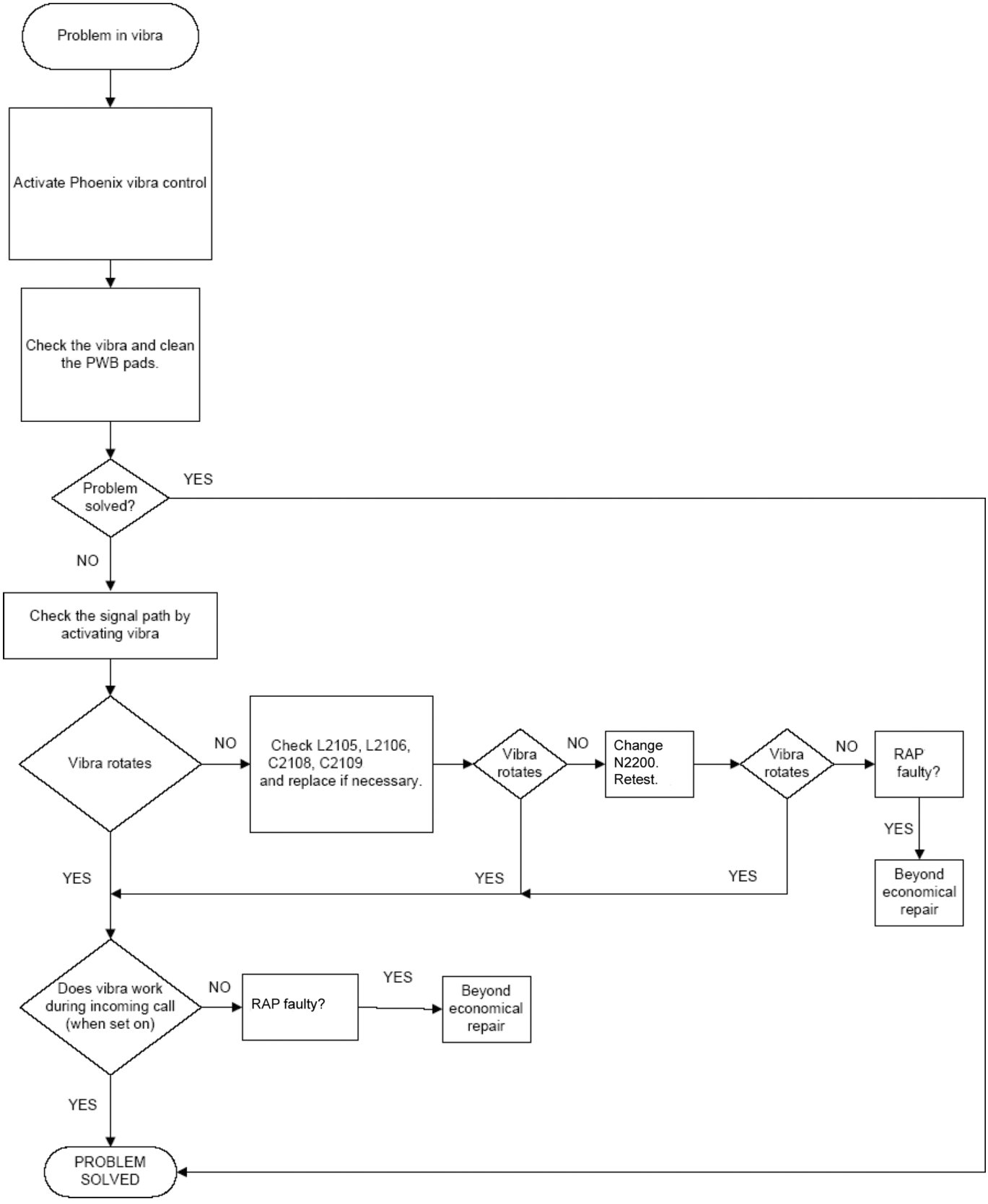
Vibra troubleshooting

Troubleshooting flow



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Baseband manual tuning guide

Energy management calibration

Before you begin

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File→ Scan Product.**
4. Choose **Tuning→Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 10 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

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7 — RF Troubleshooting and Manual Tuning Guide

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Introduction to RF troubleshooting

All measurements should be done using:

- spectrum analyser with a low-impedance wideband passive probe (LO-/reference frequencies and RF power levels).

  Note: When measuring frequencies of 4GHz, absolute level measurements are not possible with this probe. Compare levels with a known good board.

- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

  Caution: A mobile phone WCDMA transmitter should never be tested with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in wide area. WCDMA Tx measurements should be performed at least in an RF-shielded box and never with higher Tx power level than 0 dBm! Test full WCDMA Tx power only in RF-shielded environment.

  Also all measurements with an RF coupler should be performed in RF shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, it should be checked that there are no transmissions on the same frequencies as used in the tests.

The RF section of the phone is built around an RF ASIC, N7505, for the US variant and RF ASIC, N7500, for the EU variant. N7500 consists of the N7505 and several filters, so there are fewer discreet components in the EU variant layout. Both versions have a GSM quad band dual PA and antenna switch module, TXFEM, N7520, and a WCDMA PA, N7540.

The WCDMA PA needs a variable supply to work efficiently. This is provided by a switch mode power supply component, N7541.

Please note that the grounding of the PA module is directly below the PA module. Therefore, it is difficult to check or change the module.

Most RF semiconductors are static discharge sensitive. ESD procedures must be followed during repair, ground straps and ESD soldering irons. RF ASICs, TXFEM, PA and SMPS are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

A Capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware, in-circuit measurements should be evaluated carefully.

Keep in mind that all measured voltages or RF levels in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used. All spectrum analyser measurements in this manual are made with a Fluke PM9639/011 10:1 (500 ohm) probe. It is recommended that a similar kind of probe is used for all troubleshooting measurements.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig, then “GND” pads should be used for the probe ground.

For additional RF troubleshooting instructions, see Appendix A. These instructions include descriptions/ instructions for RF self-tests as well as troubleshooting instructions for various fault cases.

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RF key component placement

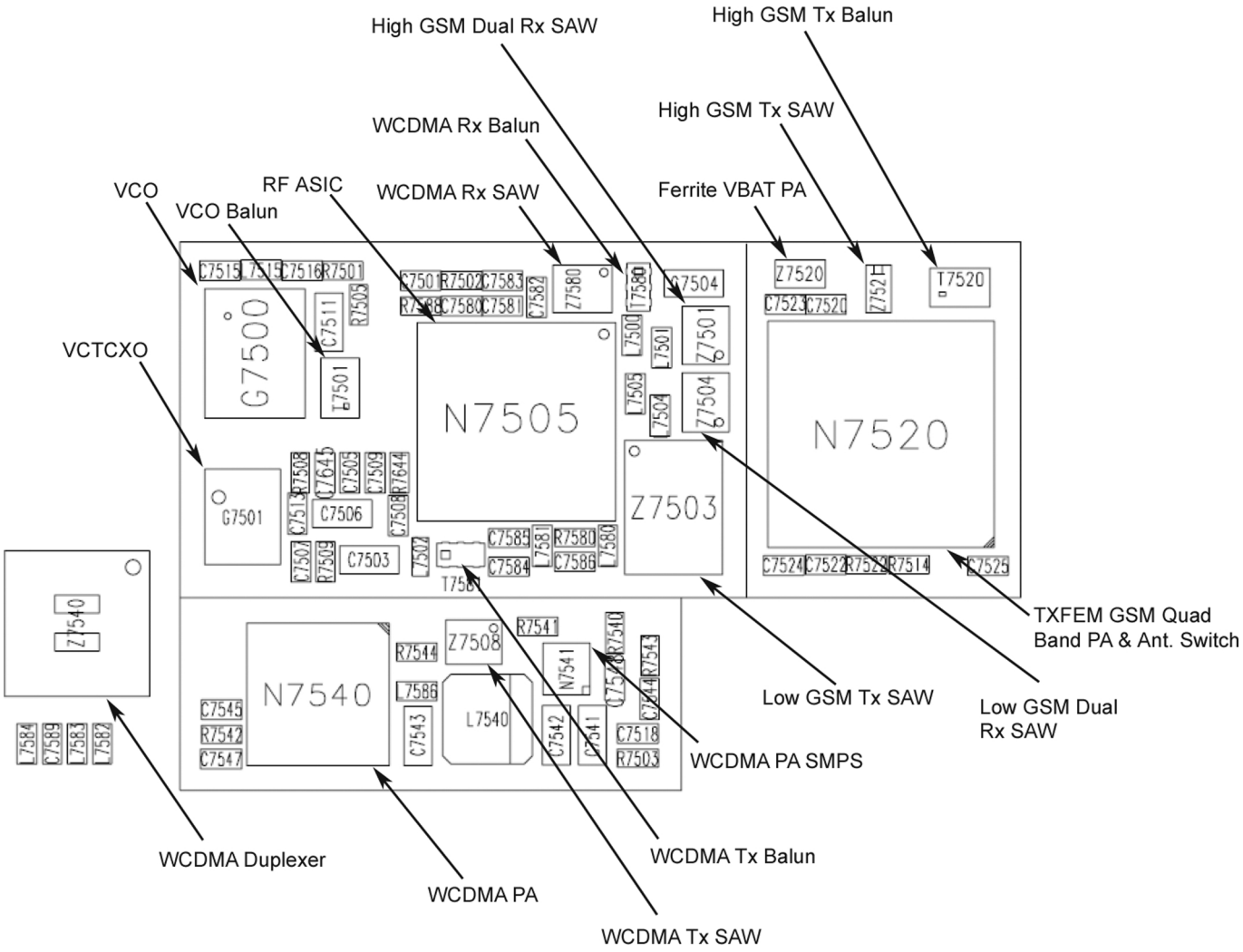

Figure 55 RM-91 RF key component placement

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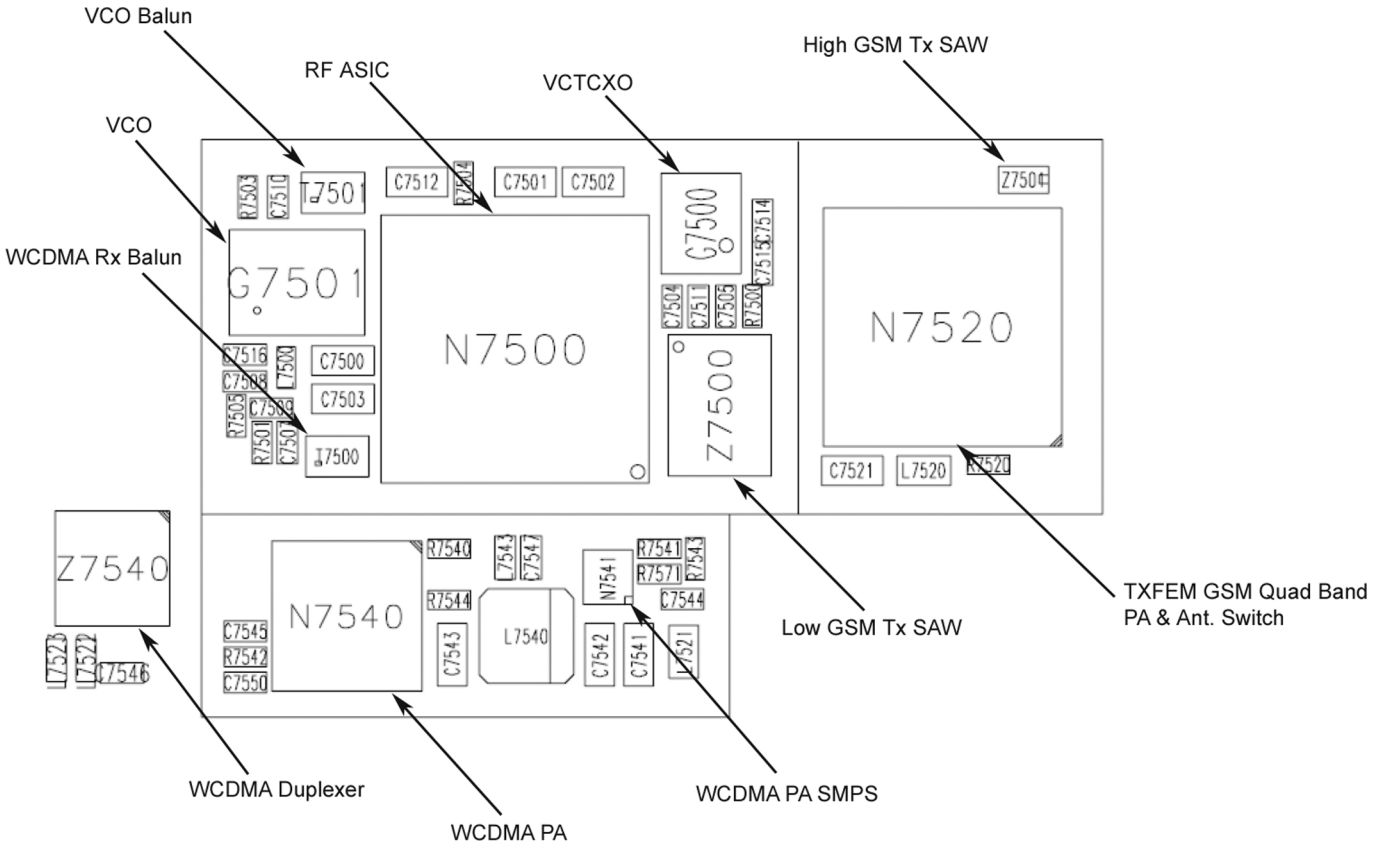

Figure 56 RM-92 RF key component placement

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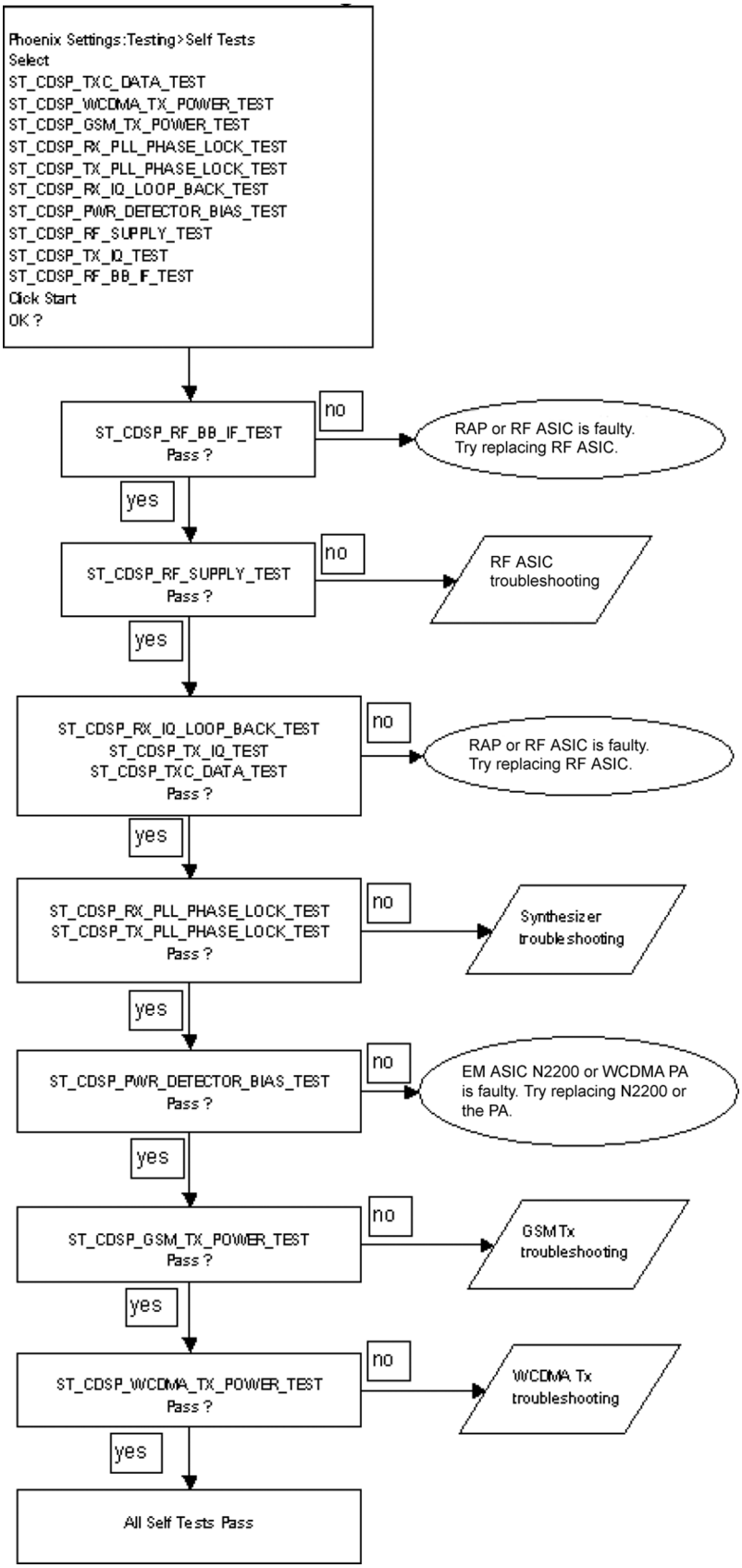
Self test troubleshooting

Troubleshooting flow



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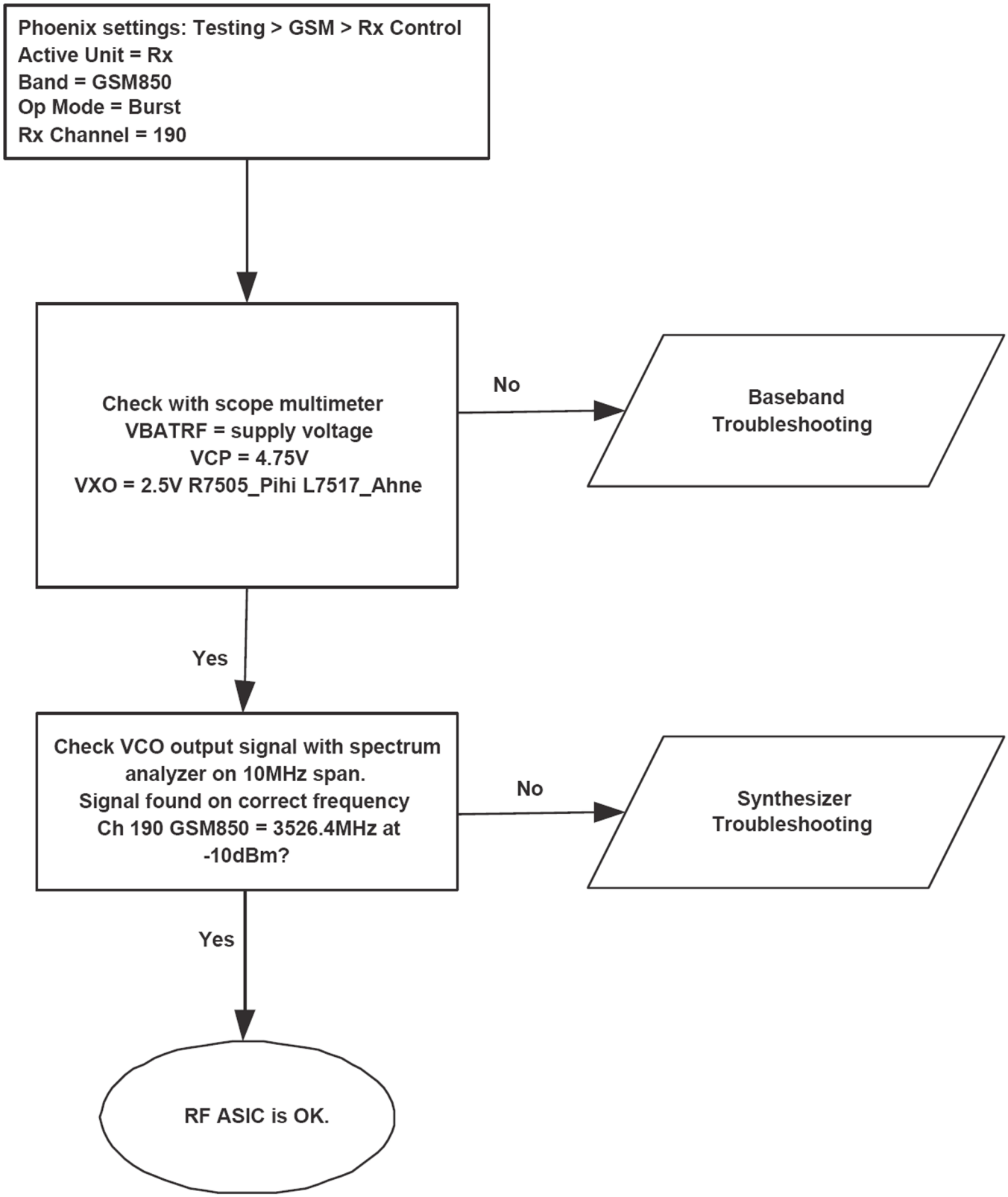
RF ASIC troubleshooting

Troubleshooting flow



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RF ASIC test points

Signal name	RF ASIC N7505	RF ASIC N7500	Expected Result V
VBATRF	C7503	C7500	3.6
VCP (VCP1 & VCP2)	C2222	C2222	4.75
VXO	C7513	C7504	2.5
VREFRF01	C7518	C7507	1.35

Signal name	RF ASIC N7505	RF ASIC N7500
RFBUSDAT	J7504	J7504
RFBUSCLKRF	J7505	J7505
RFBUSENA	J7506	J7506
TXRESETX	No test point	J7515

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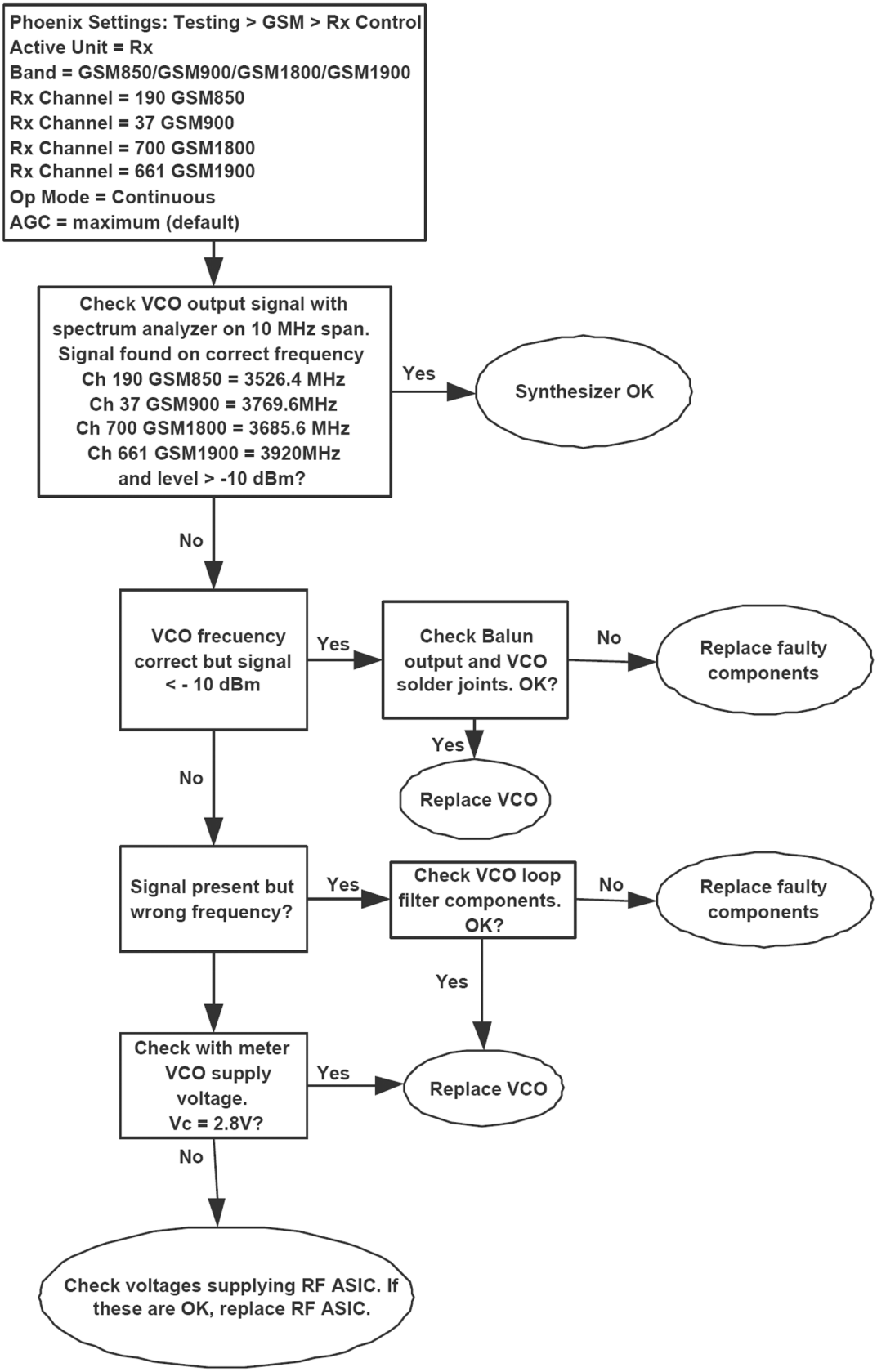
Synthesizer troubleshooting

Troubleshooting flow



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Synthesizer test points

Measure	RF ASIC N7505	RF ASIC N7500	Expected Result
VCTXCO output voltage	G7501 pin 3	G7500 pin 3	38.4MHz 800 mVpp
RFCLKEXT			38.4MHz 500 mVpp
VCTXCO AFC voltage	C7507	C7505	1V

Measure	RF ASIC N7505	RF ASIC N7500	Expected Result
VCO	G7500	G7501	3526,4 MHz

Measure	RF ASIC N7505	RF ASIC N7500	Expected Result
VCO supply voltage	L7515	C7509	2.8V

Measure	RF ASIC N7505	RF ASIC N7500	Expected Result
VCO control voltage	C7516	C7510	1 to 3 V

RF ASIC N7505	RF ASIC N7500
C7516, C7511, R7501, R7511	C7510, C7512, R7503, R7504

Receiver troubleshooting

Introduction to Rx troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.

The primary Rx troubleshooting parameter RSSI (Receiving Signal Strength Indicator). For GSM RSSI measurement, see GSM Rx chain activation for manual measurements / GSM RSSI measurement (page 7–13), and for the same measurement in WCDMA, see WCDMA RSSI measurement (page 7–14).

In GSM, the input signal can be either a real GSM signal or a CW (Continuous Wave) signal, which is 67.771 kHz above the carrier frequency.

In WCDMA, the input signal can be either a real WCDMA signal or a CW signal, which is 1 MHz above the carrier frequency.

For service tool usage instructions, refer to section **Service Tools and Service Concepts**.

See also

- WCDMA Rx chain activation for manual measurement (page 7–13)

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GSM Rx chain activation for manual measurements / GSM RSSI measurement

Context

RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either real GSM signal or a CW (Continuous Wave) signal that is 67.771 kHz above the carrier frequency.

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→GSM→RSSI Reading** .
3. Set the RF signal generator for channel frequency +67.771 kHz CW mode with –90 dBm signal.

   Alternatively set the cellular tester downlink channel to the appropriate channel. Make sure that the tester is set to continuous mode, not to burst mode.
4. In the *RSSI Reading* window, select the appropriate band and channel.

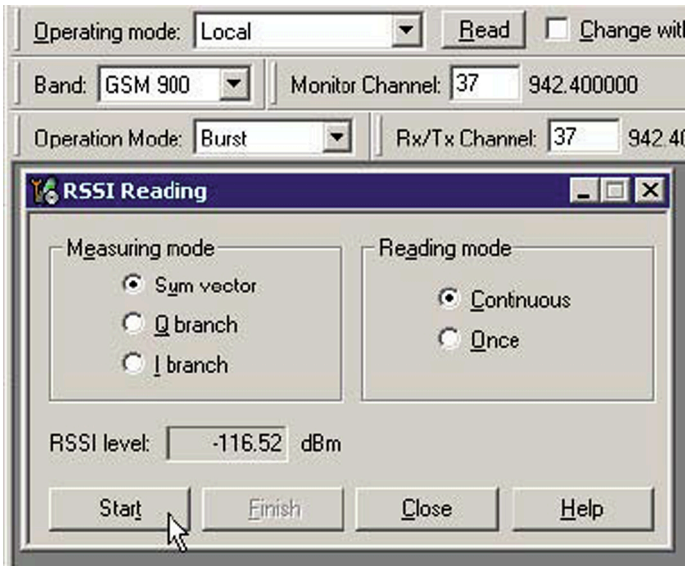

Figure 57 *RSSI Reading* window

5. To start the measurement/activate GSM Rx chain, click **Start**.

Results

RSSI reading values of the selected band and channel are displayed. The RSSI level must be the same value which is set at the signal generator (-90 dBm).

WCDMA Rx chain activation for manual measurement

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→WCDMA→Rx Control** .
3. In the *Rx Control* window:

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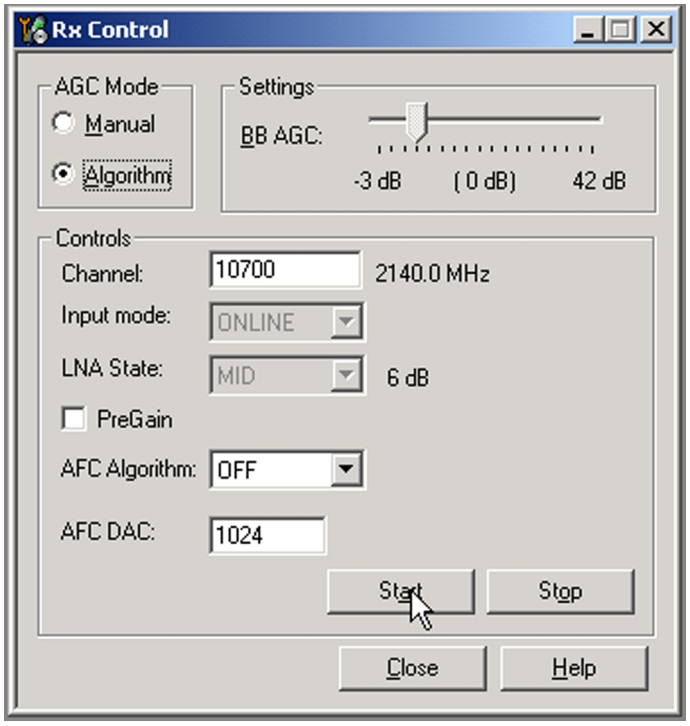

Figure 58 *Rx Control* window

- Set **AGC Mode** to **Algorithm**.
- Set **Channel** to **10700**.
- Set **AFC Algorithm** to **OFF** (Default = **OFF**).

Next action

When settings are ready, click **Start** to activate them.

If settings are changed later on (for example, you give a new channel number), you will need to click **Stop** and **Start** again.

Note: Clicking **Stop** also disables **Tx Control** if that was active!

WCDMA RSSI measurement

Before you begin

WCDMA Rx must be activated before RSSI can be measured. See WCDMA Rx chain activation for manual measurement (page 7–13).

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→WCDMA→Rx Power Measurement** .
3. In the *Rx Power Measurement* window, choose the following settings:
   - Mode: RSSI
   - Continuous Mode

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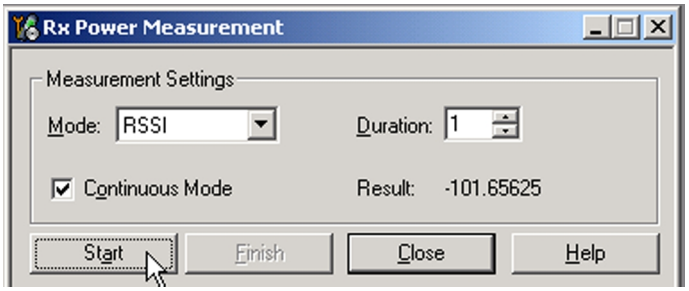

4. To perform the measurement, click **Start**.

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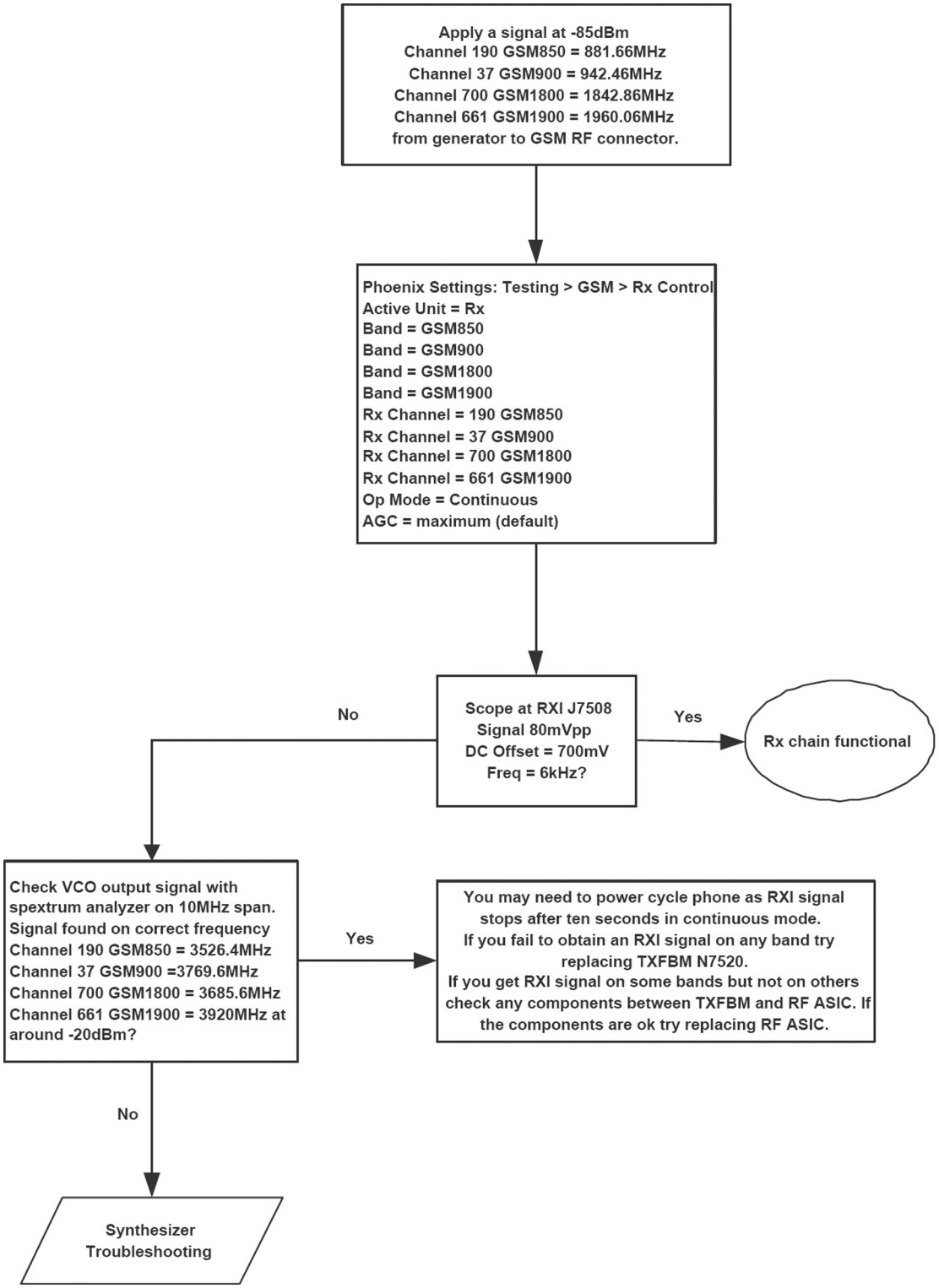
GSM receiver troubleshooting

Troubleshooting flow



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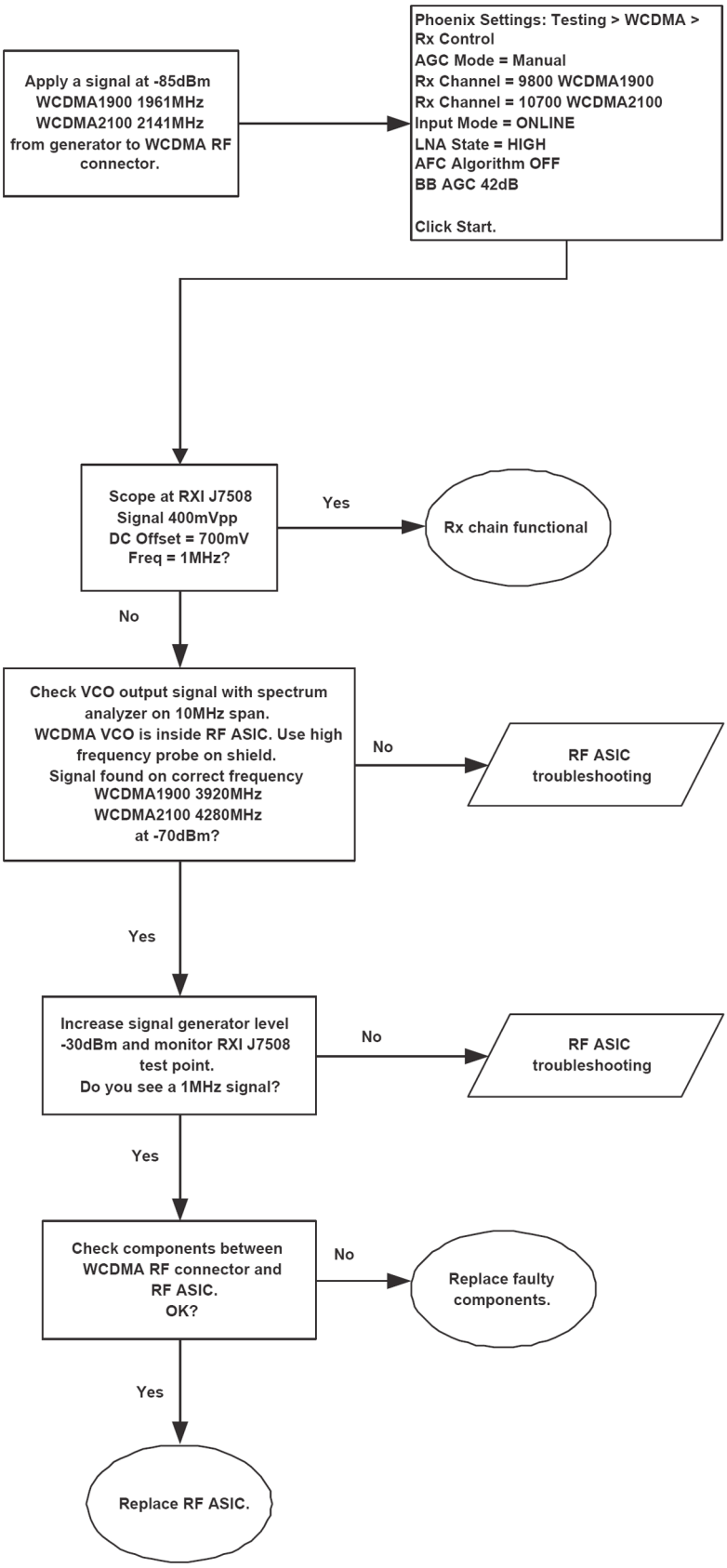
WCDMA receiver troubleshooting

Troubleshooting flow



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Receiver test points

Measure	RF ASIC N7505	RF ASIC N7500	Expected Result
RXIP	J7508	J7508	400 mVpp and 700mVDC
RXIN	U87	J7509	400 mVpp and 700mVDC
RXQP	J7510	No test point	400 mVpp and 700mVDC
RXQN	J7529	No test point	400 mVpp and 700mVDC

Band	RF ASIC N7505	RF ASIC 7500	Expected Result
GSM850	L7504	No test point	881,66771 MHz at 50dBm
GSM900	L7505	No test point	942,46771 MHz at 50dBm
GSM1800	L7501	C7515	1842,86771 MHz at 50dBm
GSM1900	L7500	C7514	1960,06771 MHz at 50dBm

Transmitter troubleshooting

General instructions for Tx troubleshooting

Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use.
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The best diagnostic tool for GSM transmitter testing is **RF Controls**, and for the WCDMA transmitter testing **Tx Control**.

  Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a repair procedure.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software. The first section is for the EGSM900/GSM1800/GSM1900 bands and the latter for WCDMA.

> **Caution:** Never activate the GSM or WCDMA transmitter without a proper antenna load. There should be always 50 ohm load connected to the RF connector (antenna, RF-measurement equipment or at least 2 watts dummy load), otherwise GSM or WCDMA PA may be damaged.

Steps

1. Connect a module jig to a computer with a DAU-9S cable or to a FPS-10 flash prommer with a modular cable.

   Make sure that you have a PKD-1 dongle connected to the computer parallel port.

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2. Connect a DC power supply to a product-specific module jig.

   Note: When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.

   Set the DC supply voltage to 3.9 V.

3. Connect an RF cable between the RF connector of the product-specific module test jig and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector; otherwise GSM or WCDMA PA may be damaged.

   Note: There are three antenna connectors in the module jig:

   - one for GSM
   - one for WCDMA
   - one for Bluetooth and WLAN* (* = if applicable)

   Make sure that all connections are made to the correct RF connector.

   Normally a spectrum analyser is used as measurement equipment.

   Note: The maximum input power of a spectrum analyser is +30 dBm.

   To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.

4. Set Tx on.

   i Place the phone module to the test jig and start *Phoenix* service software.

   ii Initialize connection to the phone (with FPS-10 use FBUS when using a DAU-9S cable and a COMBOX driver).

   iii Choose **File→Open Product→xx-x*** (* = type designator of the phone) or **File→Scan Product.** .

   iv From the toolbar, set **Operating mode** to **Local.**

Alternative steps

- EGSM900/GSM1800/GSM1900 troubleshooting

  i Choose **Testing→GSM→RF Controls.**

  ii In the *RF Controls* window:

  - Choose **Band**: **GSM900** or **GSM1800** or **GSM1900** (Default = **GSM900**).
  - Set **Rx/Tx channel** in the following way:
    - GSM900: **37**
    - GSM1800: **700**
    - GSM1900: **661**
  - Set **Active unit** to **Tx** (Default = **Rx**).
  - Set **Operation Mode** to **Burst** (Default = **Burst**).
  - Set **Edge** to **Off** (Default).
  - Set **Tx Data Type** to **All 1** (Default = **All 1**).
  - Set **Tx PA Mode** to **High** (Default).
  - Set **Tx Power Level** in the following way:
    - GSM900: **5** (Default = **19**)
    - GSM1800: **0** (Default = **15**)
    - GSM1900: **0** (Default = **15**)

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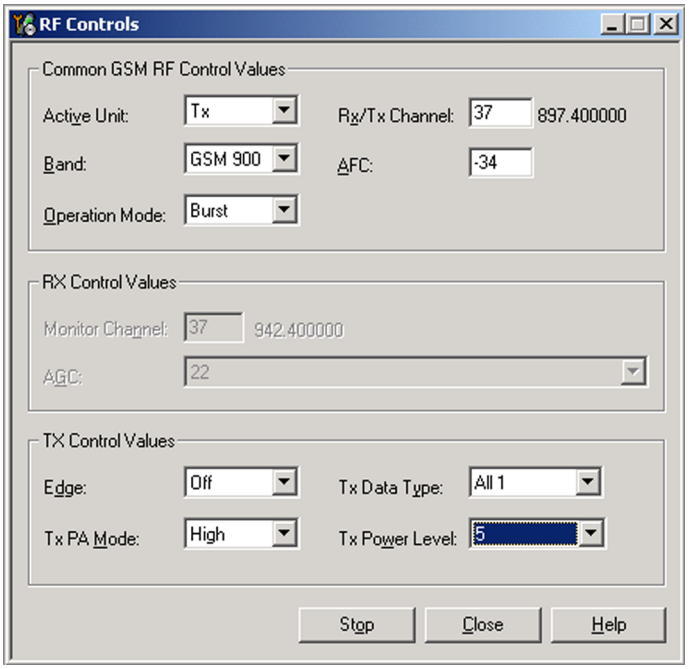

Figure 59 *RF Controls* window

- WCDMA troubleshooting
  i Choose **Testing→WCDMA→Tx Control.**
  ii In the *Tx Control* window:
    - Select the **Algorithm mode** tab.
    - Set **Start level** to **0** dBm (Default = **0**).
    - Set **Step size**, **Step count** and **Sequence** to **0** (Default = **0**).
    - In the **Scrambling code** pane set **Code class** to **LONG** (Default = **LONG**), and **Code** to **16** (Default = **16**).
    - For **DPDCH** set the following values:
      - **Code number**: **0**
      - **Code class**: **2**
      - **Weight**: **15**
    - For **DPCCH** set the following values:
      - **Code number**: **0**
      - **Code class**: **2**
      - **Weight**: **8**
    - Set **Channel** to **9750**.
    - Check the **DPDCH enabled** check box (Default).

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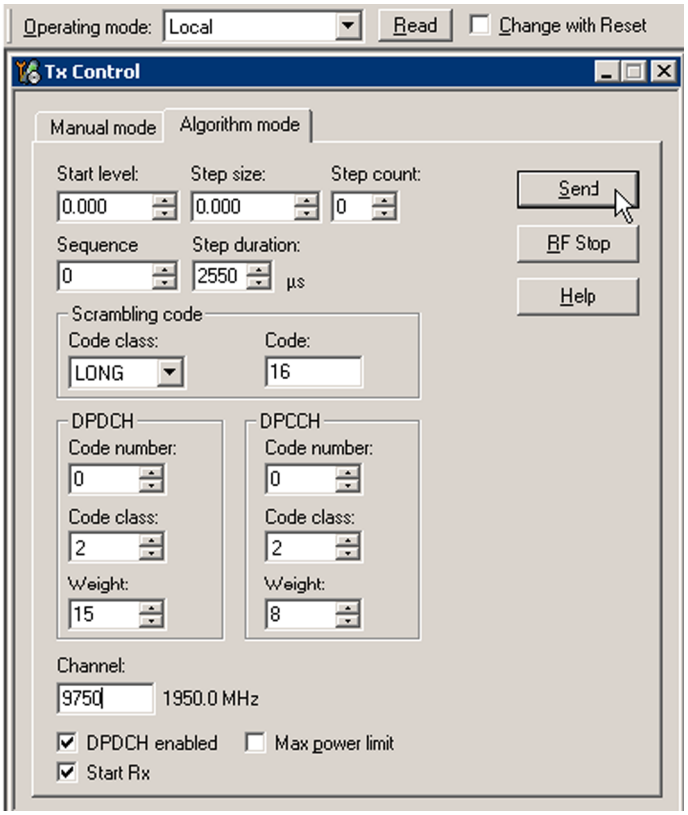

Figure 60 ***Tx Control*** **window**

Next action

When settings are done, click **Send** to enable them.

If you change the settings (e.g. give a new channel number), you need to click **Stop** and **Send** again.

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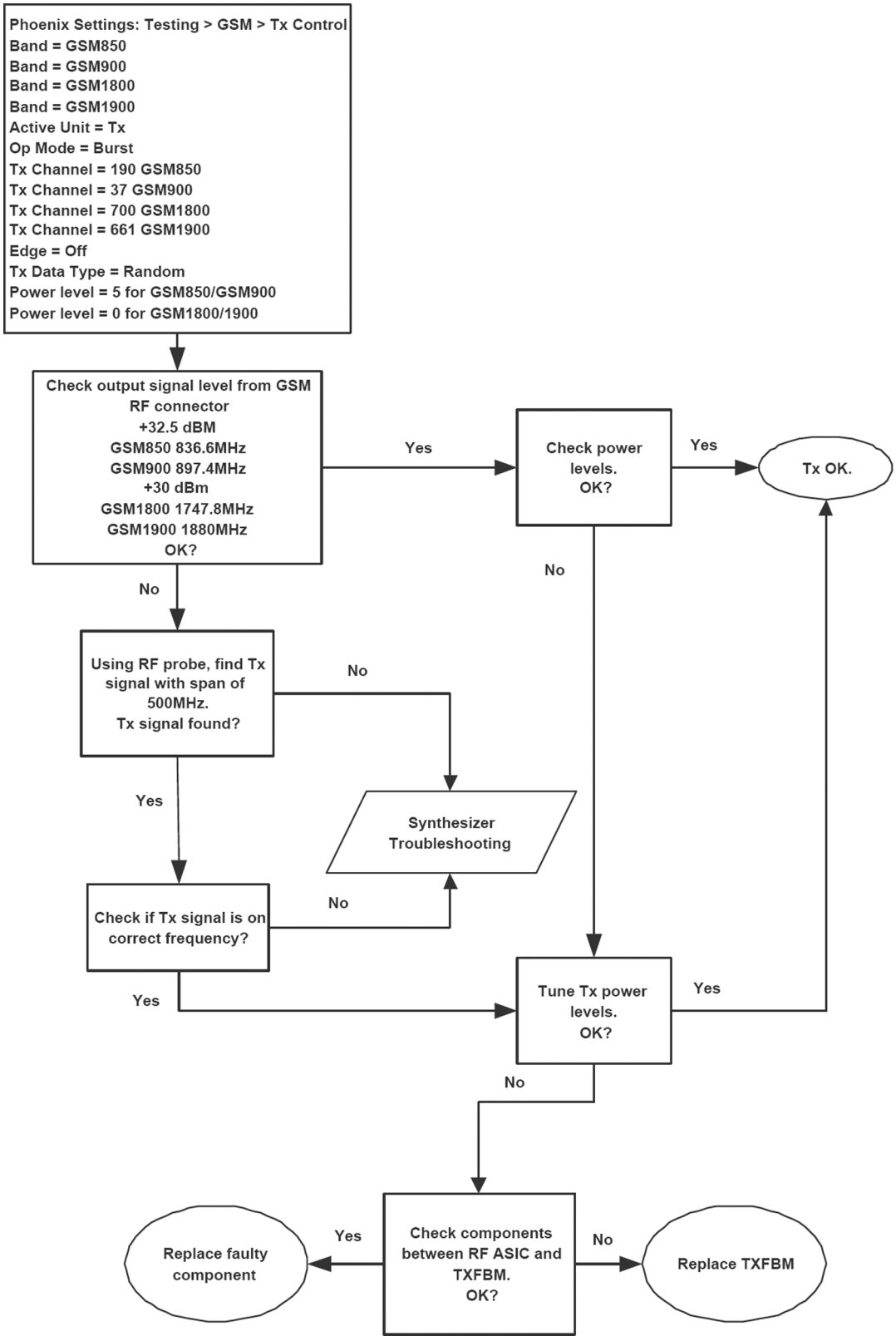
GSM transmitter troubleshooting

Troubleshooting flow



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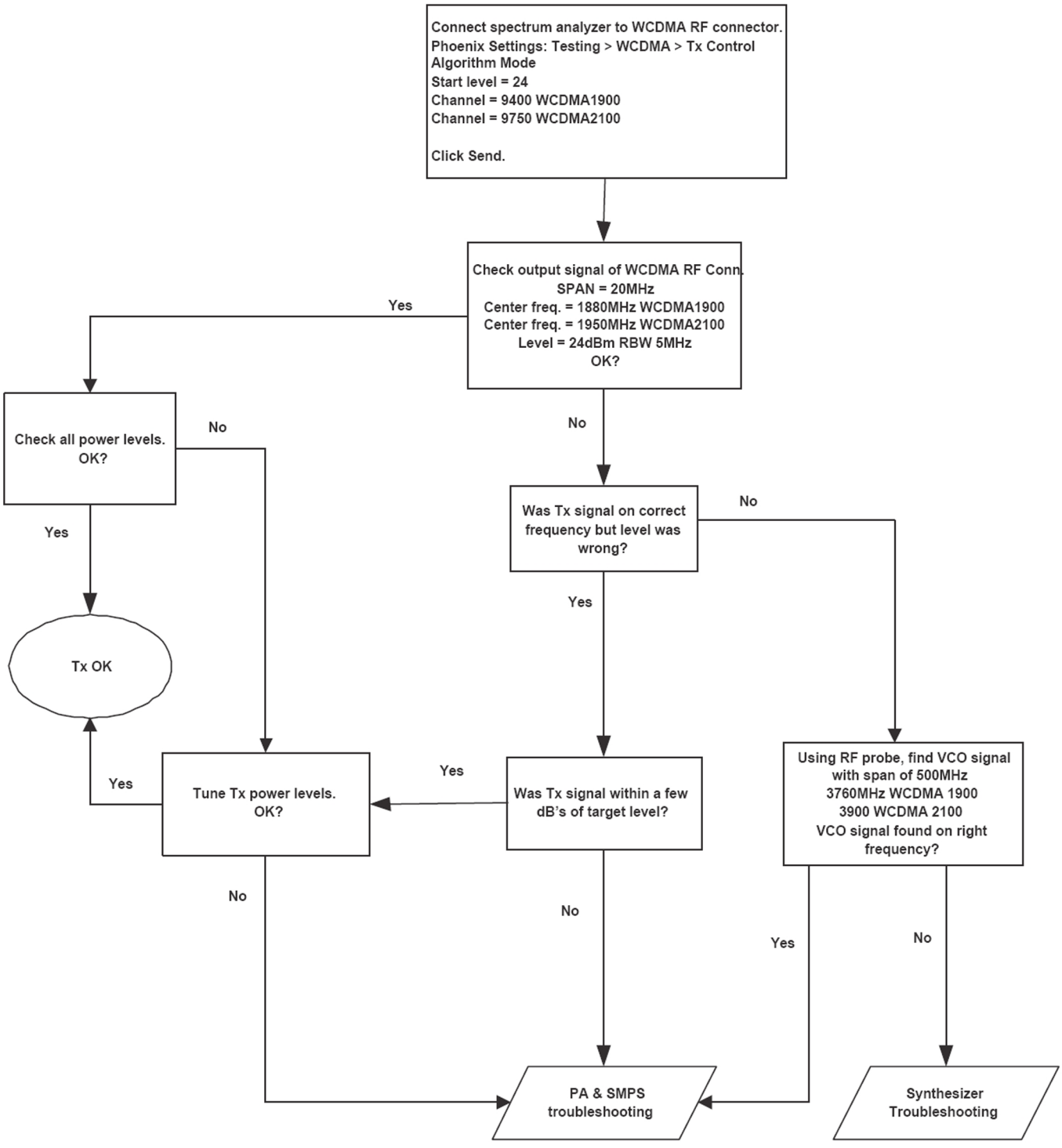
WCDMA transmitter troubleshooting

Troubleshooting flow



Transmitter test points

Band	RF ASIC N7505	RF ASIC N7500	Expected Result
GSM850	R7514	No test point	836,6 MHz

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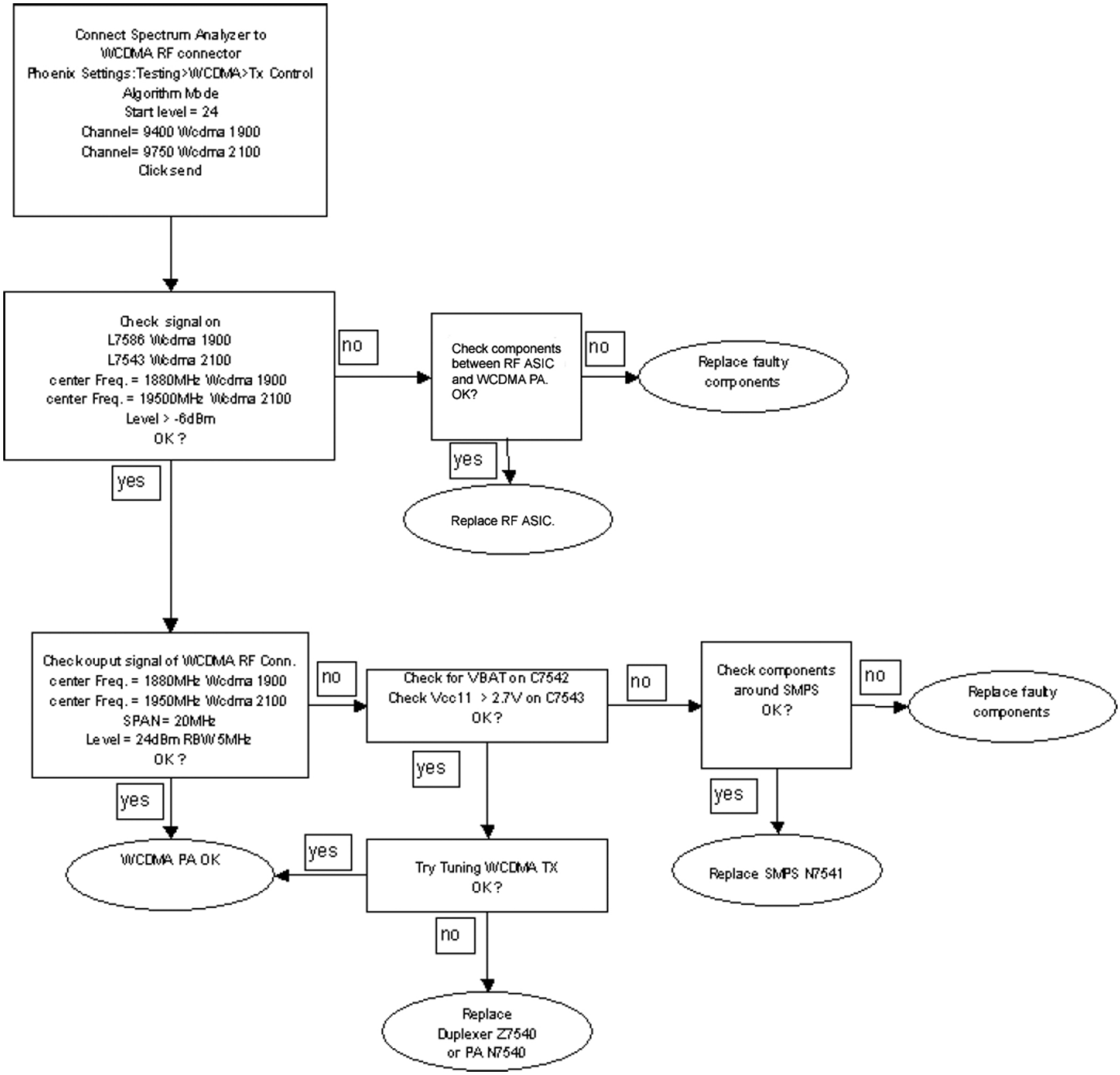
Band	RF ASIC N7505	RF ASIC N7500	Expected Result
GSM900	R7514	No test point	897,4 MHz
GSM1800	R7523 (no fit)	L7541 (no fit)	1747,8 MHz
GSM1900	R7523 (no fit)	L7541 (no fit)	1880,0 MHz

Power amplifier (PA) and switch mode power supply (SMPS) troubleshooting

Troubleshooting flow



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RF tunings

Introduction to RF tunings

Phone RF is tuned in production. There is no reason to do the re-calibration unless:

- One or more of the RF components is changed
- FLASH memory chip (D5000) is changed or otherwise corrupted.

Note: RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF side.

Important: After RF component changes, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all the RF losses are frequency dependent, the user have to be very careful and understand the measurement setup. The following table presents the RF attenuations of the product-specific module jig:

Band	Attenuation
GSM850	0.25dB
GSM900	0.25dB
GSM1800	0.4dB
GSM1900	0.45dB
WCDMA 1900	0.45dB
WCDMA 2100	0.5dB

RF autotuning

Before you begin

For information on the recommended test set-up, refer to the corresponding information on the Partner Website or Nokia Online.

Before you can use the autotuning feature, the GPIB driver from the GPIB card vendor must be installed and running.

The autotune **.xml** file must be in a correct place: **C:\Program Files\Nokia\Phoenix\products\xx-x*\rfconf_xx-x*.xml** (**= indicates the type designator of the phone, e.g. RM-1*)

Context

RF autotuning is performed with the aid of a digital radio communication tester.

Autotuning covers all RF tunings that are needed to perform after RF component repairs.

Note: Do not perform RF autotuning without a proper reason. Autotuning may only be performed after component repairs or if the RF tuning information is lost.

Steps

1. Connect the communication tester to the GPIB bus.
2. Start *Phoenix* service software.

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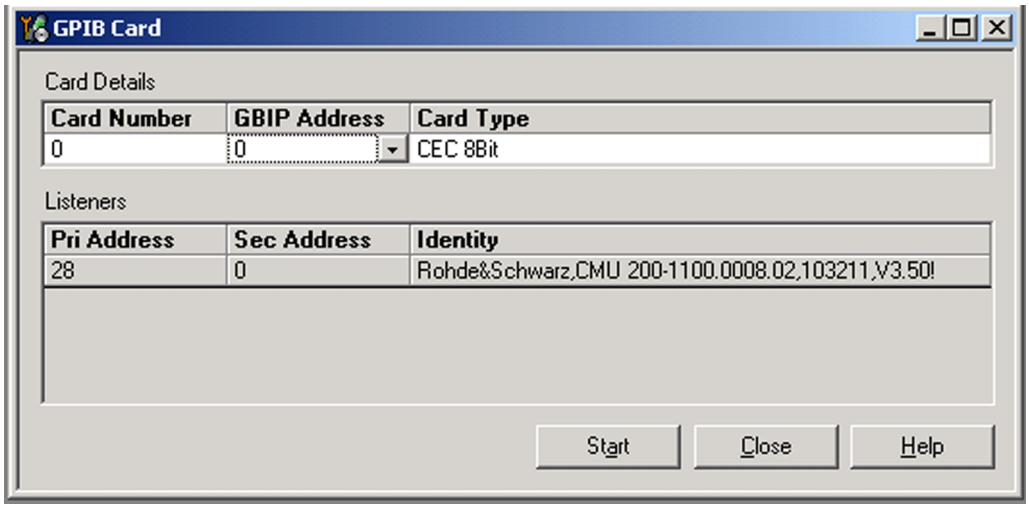
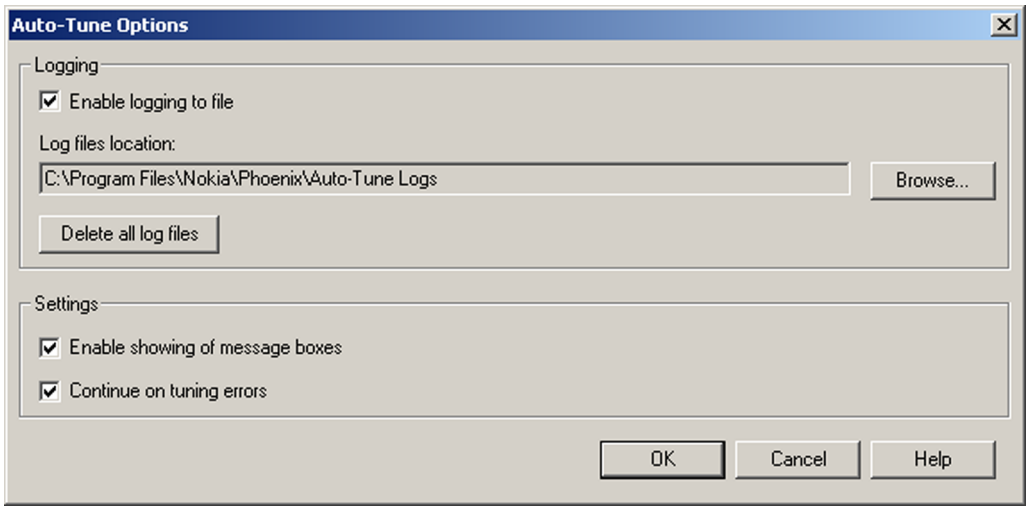
3. Choose **Tools→Options→GPIB Card.**
4. From the **Card Type** drop-down menu, choose the GPIB card used, then click **Start**.
   The name of the communication tester appears in the **Listeners** pane.



5. To specify the cable loss from a module jig to the communication tester, choose **Set Loss** from the **Tuning** menu.
6. In the *Set Loss* window, click the **Jig** tab, and select the right jig for the phone from the drop-down list.
   Alternatively, you can add a new jig by clicking **Add**, and selecting the desired jig from the list.
7. Click the **Cable** tab and add the extra cable attenuation.
8. To start autotuning, choose **Auto-Tune** from the **Tuning** menu.
9. In the *Auto-Tune* window, click **Options**.
10. In the *Auto-Tune options* window, ensure the **Enable showing of message boxes** check box is checked, and click **OK**.



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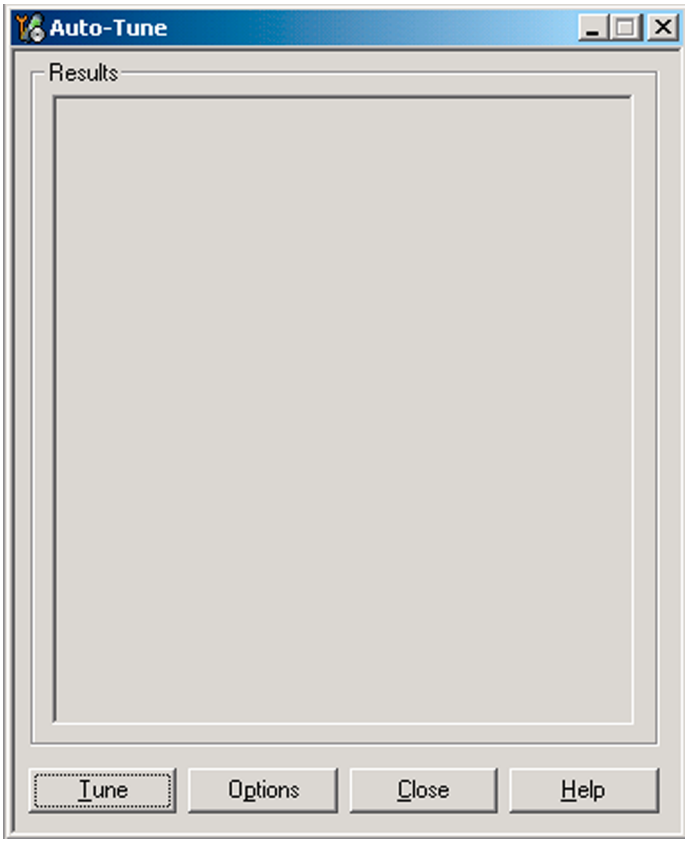
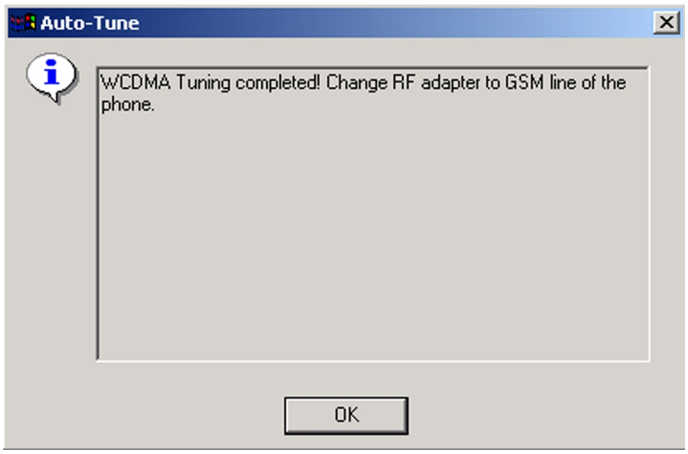
11. Connect the phone WCDMA RF port to the communication tester, and click **Tune**.



12. Change the phone RF adapter from WCDMA port to GSM port.



13. To complete the RF autotuning, click **OK**.

Results

Autotuning completed successfully! message appears.

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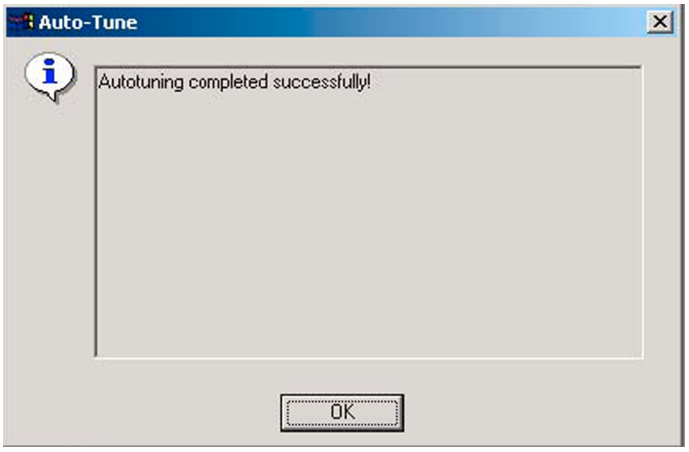

RF manual tuning guide

Required manual tunings after component changes

Important: After RF component changes, **always** use autotuning. Manual tunings are only required in rare cases.

If, however, manual tuning is used, only relevant tunings should be performed. Refer to the following table:

Changed component	Perform the following tunings
RF ASIC N7500 (RM-92) or N7505 (RM-91)	RF Channel Filter Calibration, Temperature Sensor Calibration, Rx calibration (GSM), Rx band filter response compensation (GSM), TxIQ Tuning (GSM), Tx Power Level Tuning (GSM), Rx calibration (WCDMA), Tx AGC & Power Detector (WCDMA), Tx Band Response Calibration (WCDMA), Tx LO Leakage (WCDMA)
Any component in the GSM TX RF chain before the PA	Tx IQ Tuning, Tx Power Level Tuning
Any component in the GSM TX RF chain after the PA or PA	Tx Power Level Tuning
Any component in the WCDMA TX RF chain before the PA	Tx AGC & Power Detector, Tx Band Response Calibration, Tx LO Leakage
Any component in the WCDMA TX RX chain after the PA, PA, power detector or PA switch mode power supply	Tx AGC & Power Detector, Tx Band Response Calibration, PA Detection
Any component in the GSM RX chain	Rx Calibration, RX Band Filter Response Compensation
Any component in the WCDMA RX chain	Rx AGC Alignment, RX Band Response Calibration
VCTCXO G7501 (RM-91) G7500 (RM-92)	Rx Calibration (GSM900 band)
WLAN Module (N5500)	WLAN Tx Tuning

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System mode independent manual tunings

RF channel filter calibration

Context

RF channel filter calibration tunes RF ASIC's internal low pass filters that limit the bandwidth of BB IQ signals. One common calibration is made for GSM and WCDMA.

Table 11 RF channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
Rx filter	0	16	31

Steps

1. From the "Operating mode" dropdown menu, set mode to "Local".
2. From the Tuning menu, choose "RF Channel Filter Calibration".
3. Click Tune.
4. To save the values to the PMM (Permanent Memory) area, click Write.
5. To close the tuning window, click Close.

Results

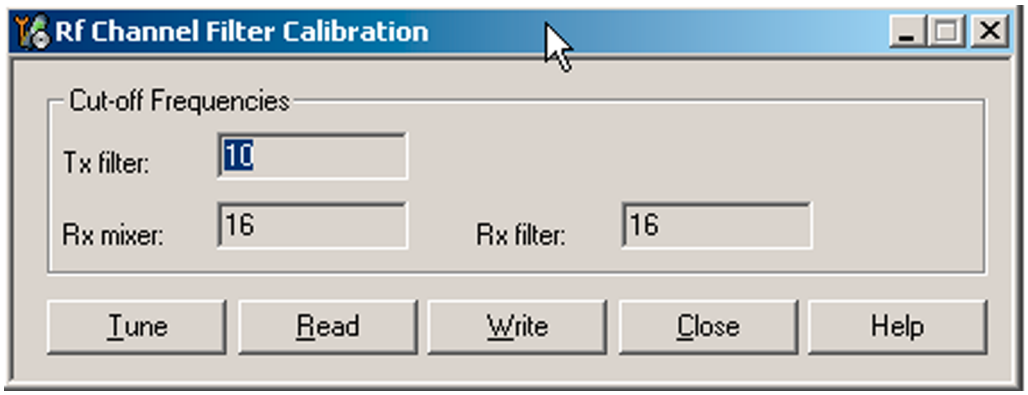

Figure 61 RF channel filter calibration typical values

PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→PA Detection** .
3. Click **Tune**.

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4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

Temperature sensor calibration

Context

There is a temperature sensor intergrated into the RF ASIC. The RF ASIC produces a DC-voltage, which is temperature dependent.

Temperature sensor calibration is done in room temperature, in which offsets caused by variations with Rx/Tx ASIC and the AD-converter inside EM ASIC N2200, are removed.

The engine calibrates itself, no external equipment is required.

The temperature of the engine must be 23°C plus or minus two degrees.

Steps

1. From the "Operating mode" dropdown menu, set mode to "Local".
2. From the Tuning menu, choose "Temperature Sensor Calibration".
3. Click "Tune".

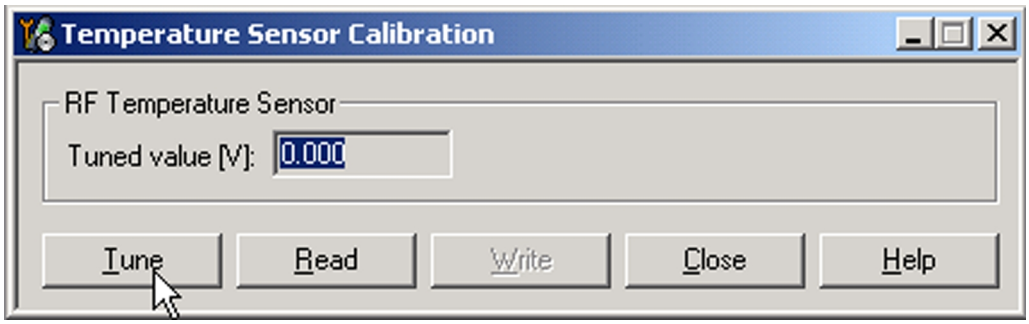

Table 12 Temperature sensor calibration tuning limits

Min	Typ	Max	Unit
-20	-4	20	V

4. To save the calibration values, click "Write".
5. To finish the calibration, click "Close".

GSM receiver tunings

Rx calibration (GSM)

Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

Steps

1. Connect the module jig's GSM connector to signal generator.
2. From the "Operating mode" dropdown menu, set mode to "Local".

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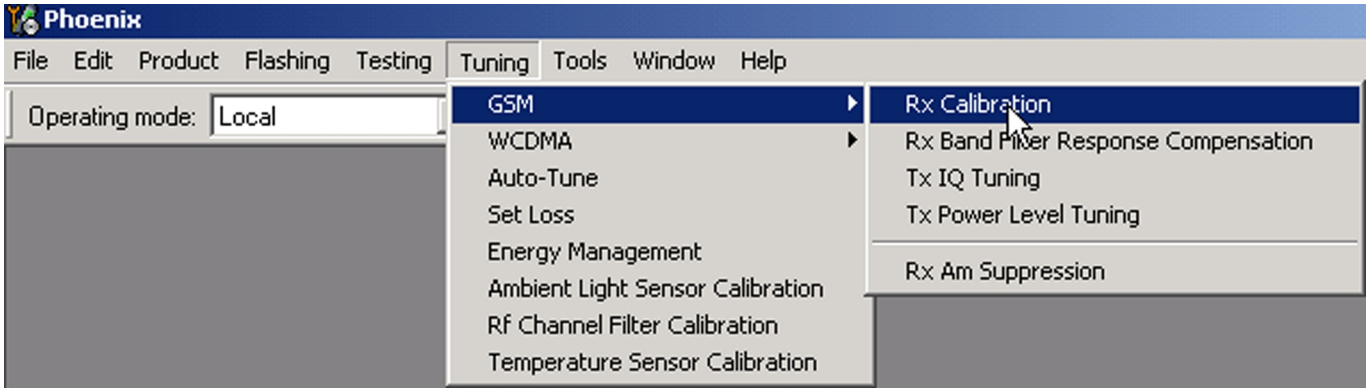
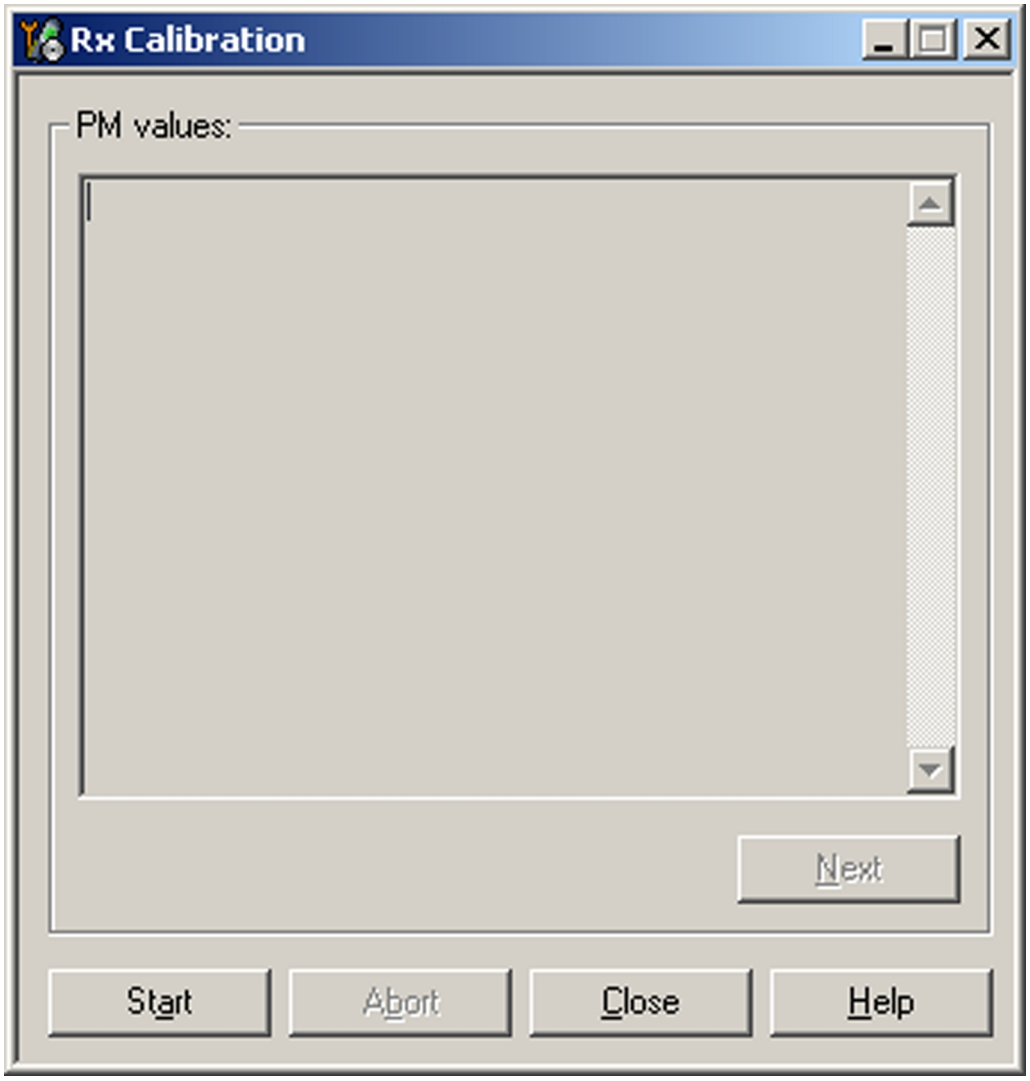
3. From the Tuning menu, choose GSM -> Rx Calibration.



4. Check the “Load from Phone” check box and clear the “Save to Phone” check box.
5. From the Band dropdown menu, choose GSM900.
6. Click Start (if not active already).



7. Click Calibrate.

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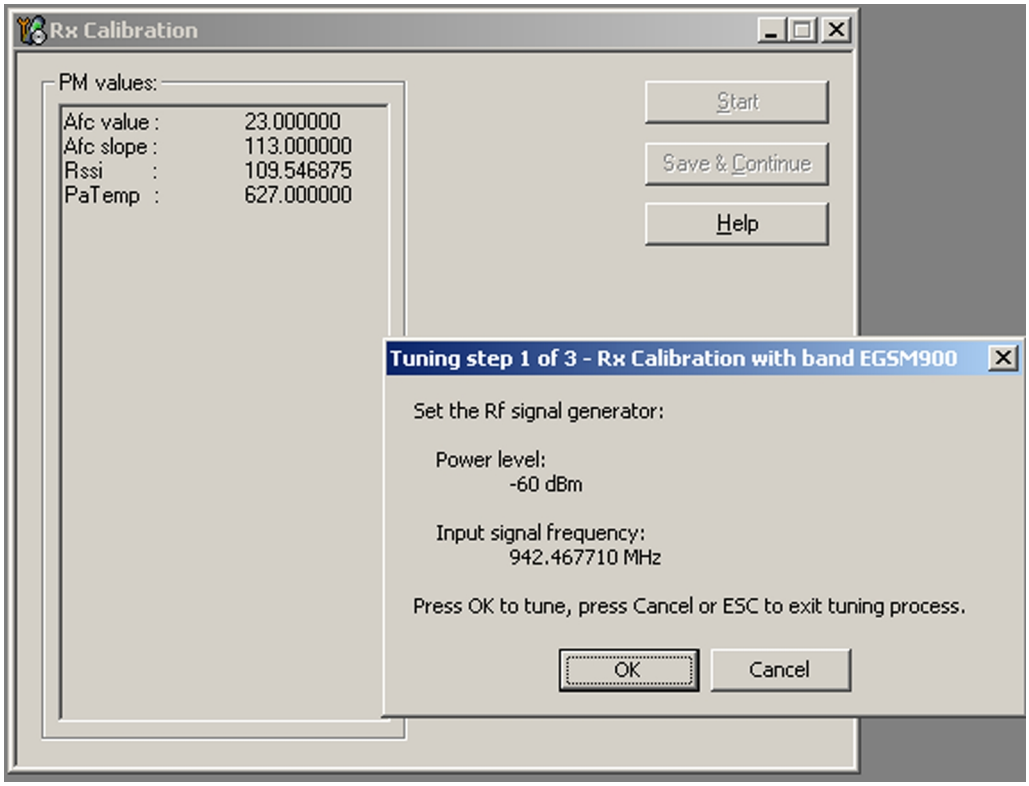
8. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Calibration with band EGSM900" popup window.

   The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation!



9. To perform tuning, click OK.
10. Check that the tuning values are within the limits specified in this table:

Table 13 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
RSSI0	106	109...110	114	dB
GSM900				
AFC Value	-200	-105...62	200	
AFC slope	0	122	200	
RSSI0	106	107...110	114	dB
GSM1800				
RSSI0	104	104...109	114	dB
GSM1900				
RSSI0	104	104...109	114	dB

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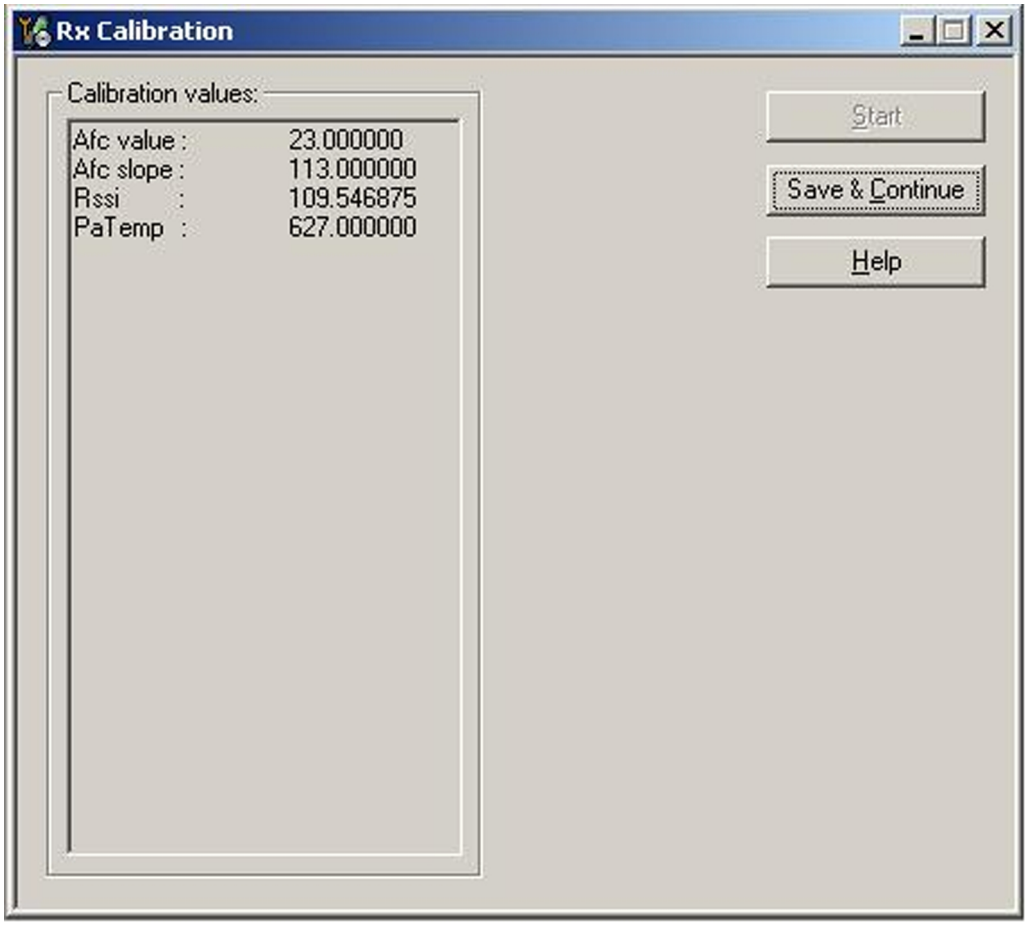
11. To save values to the phone, click "Save & Continue".



12. Repeat steps 3 to 8 for GSM850, GSM1800 and GSM1900.

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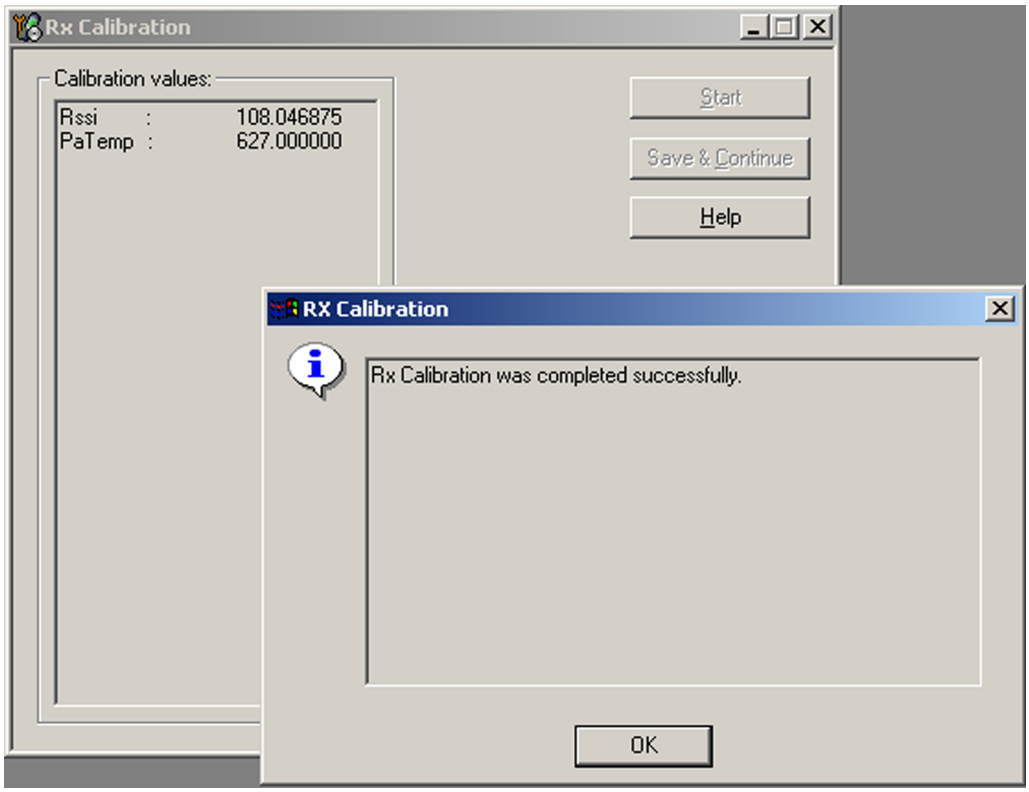
Results



Rx band filter response compensation (GSM)

Before you begin

Rx Calibration must be performed before the Rx Band Filter Response Compensation.

Context

On each GSM Rx band, there is a band rejecting filter in front of the LNA (Low Noise Amplifier). In RM-92, the filter is integrated in RF ASIC N7500, and in RM-91, there is a discreet filter in front of RF ASIC N7505. The amplitude ripple caused by these filters causes ripple to the RSSI measurement and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

Steps

1. Connect the module jig's GSM connector to the signal generator.
2. From the "Operating mode" dropdown menu, set mode to "Local".
3. Select GSM900 band.

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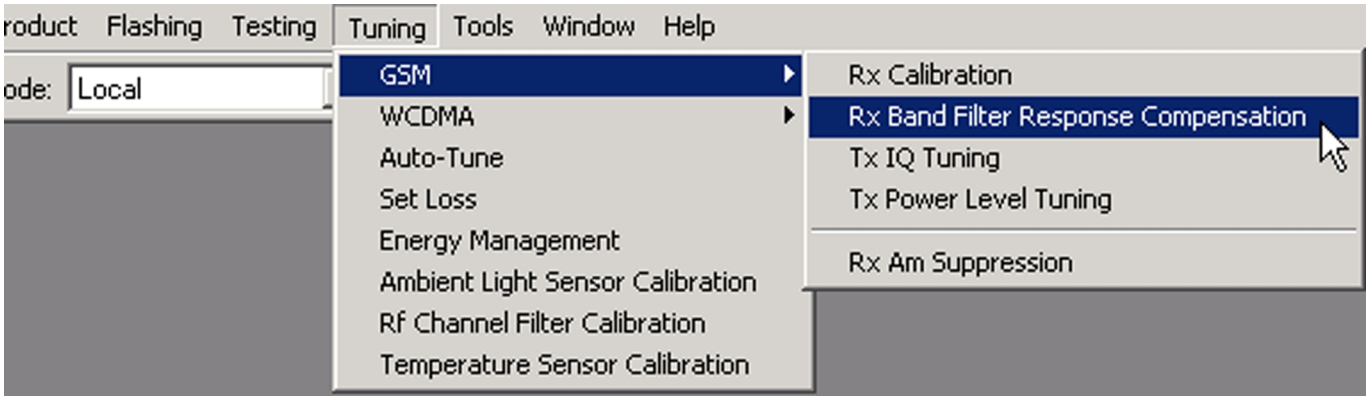
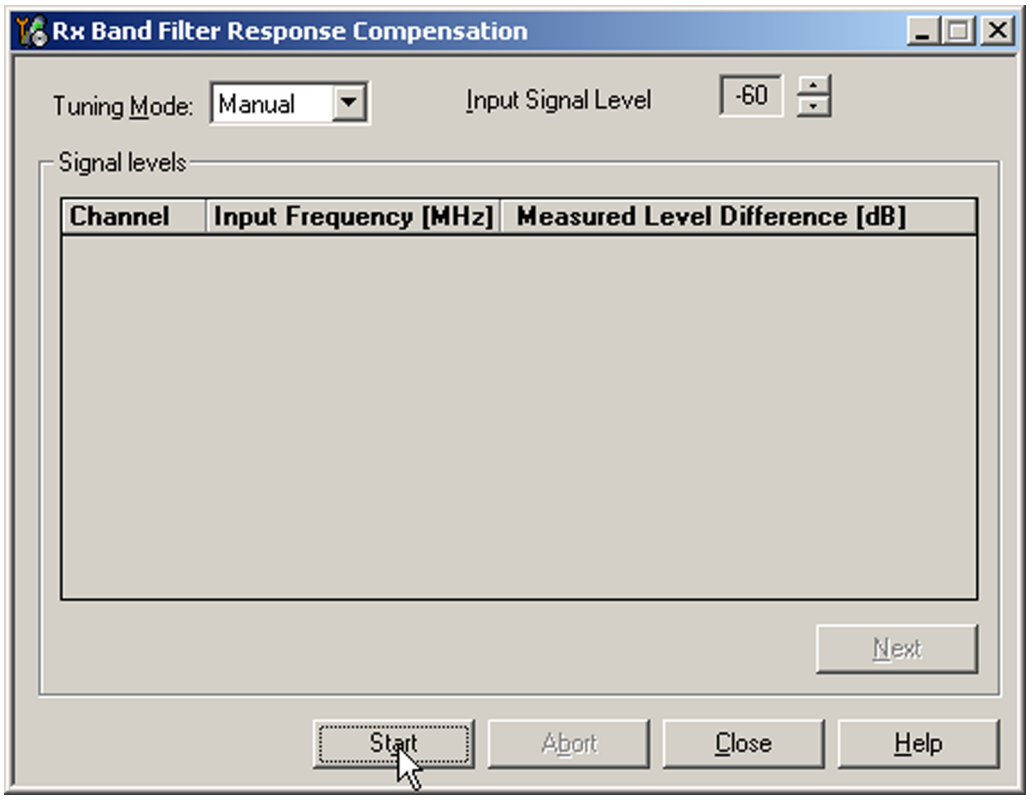
4. From the Tuning menu, choose GSM -> Rx Band Filter Response Compensation.



5. In the *Tuning mode* pane, select **Manual**.
6. Click Start.



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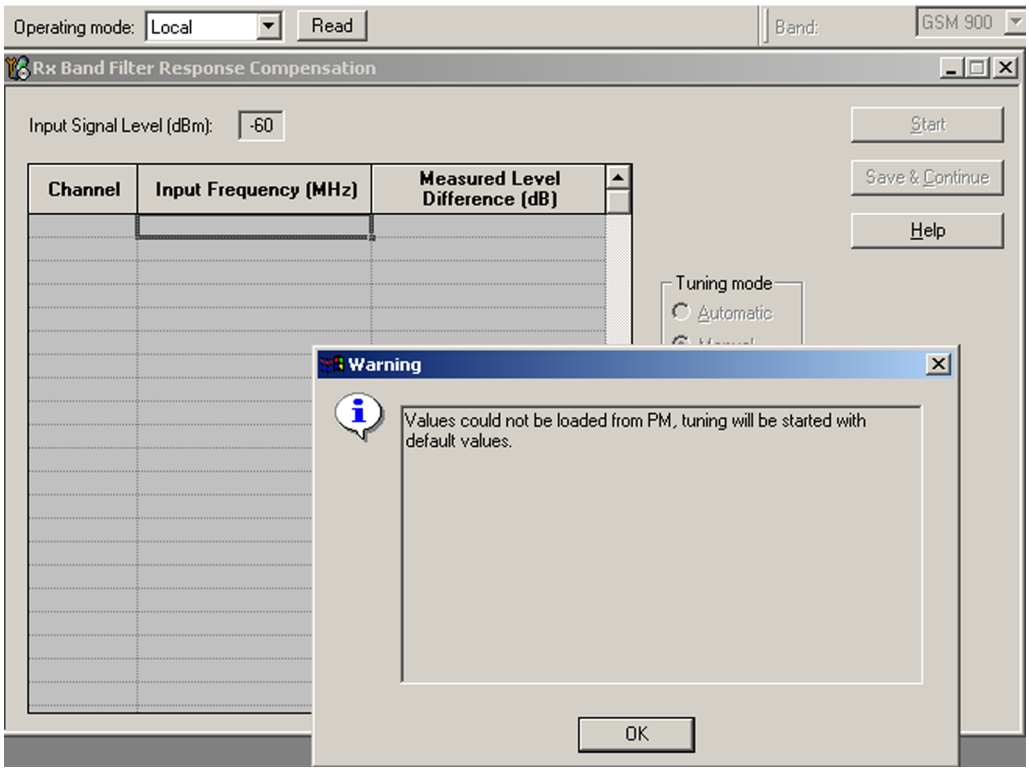
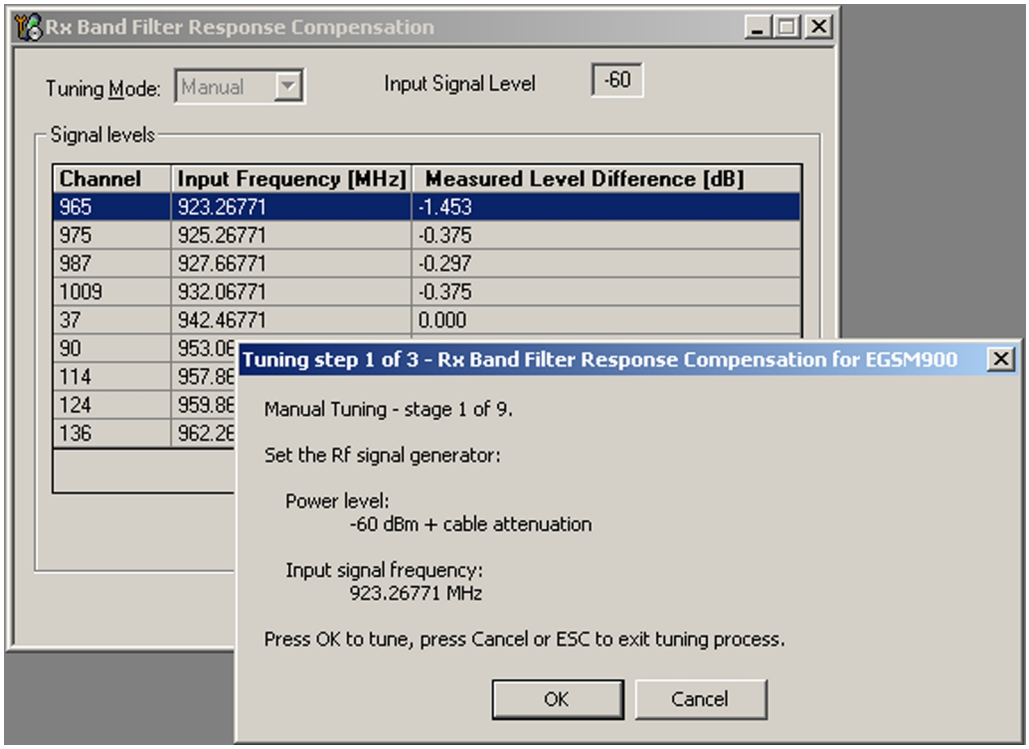
7. Click *Save & Continue*.



8. Connect the signal generator to the phone and set frequency and amplitude as instructed in the "Rx Band Filter Response Compensation for EGSM900" popup window.



9. To perform tuning, click OK.
10. Go through all 9 frequencies.

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11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118/867.26771 MHz	-10	-1	5	dB
Ch. 128/869.26771 MHz	-3	0	5	dB
Ch. 140/871.66771 MHz	-3	0	5	dB
Ch. 172/878.06771 MHz	-3	0	5	dB
Ch. 190/881.66771 MHz	-3	0	5	dB
Ch. 217/887.06771 MHz	-3	0	5	dB
Ch. 241/891.86771 MHz	-3	0	5	dB
Ch. 251/893.86771 MHz	-3	0	5	dB
Ch. 261/895.86771 MHz	-10	1	5	dB
GSM900				
Ch. 965 / 923.26771 MHz	-10	-1	5	dB
Ch. 975 / 925.26771 MHz	-3	0	5	dB
Ch. 987 / 927.66771 MHz	-3	0	5	dB
Ch. 1009 / 932.06771 MHz	-3	0	5	dB
Ch. 37 / 942.46771 MHz	-3	0	5	dB
Ch. 90 / 953.06771 MHz	-3	0	5	dB

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	Min	Typ	Max	Unit
Ch. 114 / 957.86771 MHz	-3	0	5	dB
Ch. 124 / 959.86771 MHz	-3	0	5	dB
Ch. 136 / 962.26771 MHz	-10	-1	5	
GSM1800				
Ch. 497 / 1802.26771 MHz	-10	-1	5	dB
Ch. 512 / 1805.26771 MHz	-3	0	5	dB
Ch. 535 / 1809.86771 MHz	-3	0	5	dB
Ch. 606 / 1824.06771 MHz	-3	0	5	dB
Ch. 700 / 1842.86771 MHz	-3	0	5	dB
Ch. 791 / 1861.06771 MHz	-3	0	5	dB
Ch. 870 / 1876.86771 MHz	-3	0	5	dB
Ch. 885 / 1879.86771 MHz	-3	0	5	dB
Ch. 908 / 1884.46771 MHz	-10	-1	5	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-10	-1	5	dB
Ch. 512 / 1930.26771 MHz	-3	0	5	dB
Ch. 537 / 1935.26771 MHz	-3	0	5	dB
Ch. 586 / 1945.06771 MHz	-3	0	5	dB
Ch. 661 / 1960.06771 MHz	-3	0	5	dB
Ch. 736 / 1975.06771 MHz	-3	0	5	dB
Ch. 794 / 1986.66771 MHz	-3	0	5	dB

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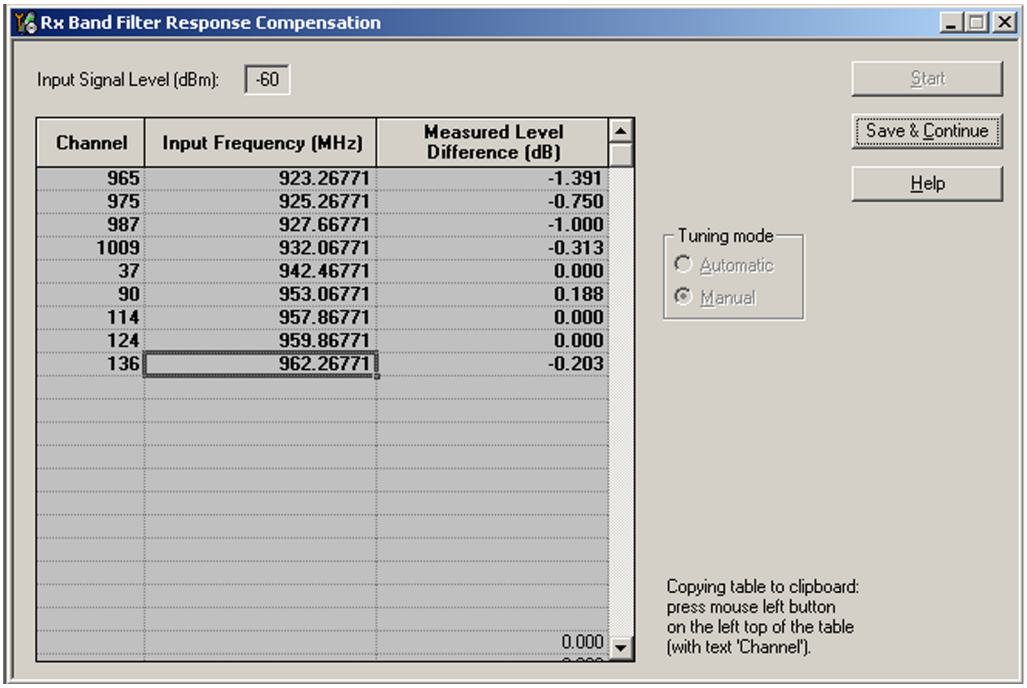
	Min	Typ	Max	Unit
Ch. 810 / 1989.86771 MHz	-3	0	5	dB
Ch. 835 / 1994.86771 MHz	-10	-1	5	dB

12. If the values are within the limits, click "Save & Continue".



13. Repeat the steps 4 to 10 for GSM850, GSM1800 and GSM1900.

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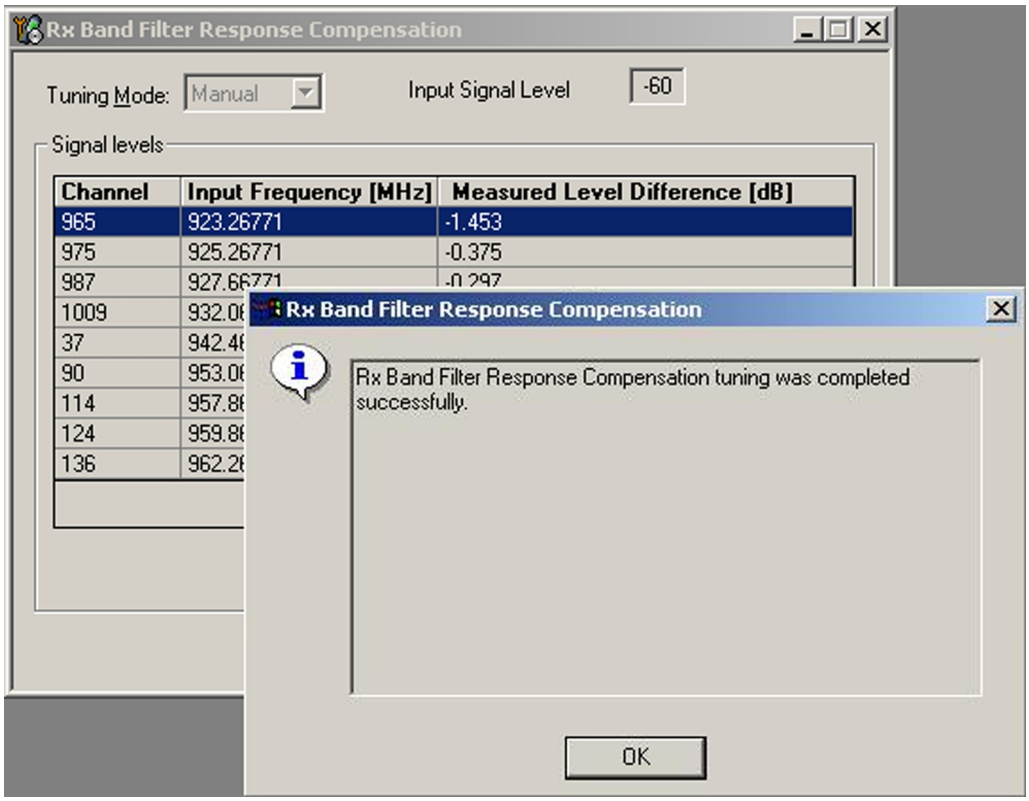
Results



GSM transmitter tunings

Tx IQ tuning (GSM)

Context

- The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.
- Tx IQ tuning must be performed on all GSM bands.

Steps

1. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and "Band" to GSM900.

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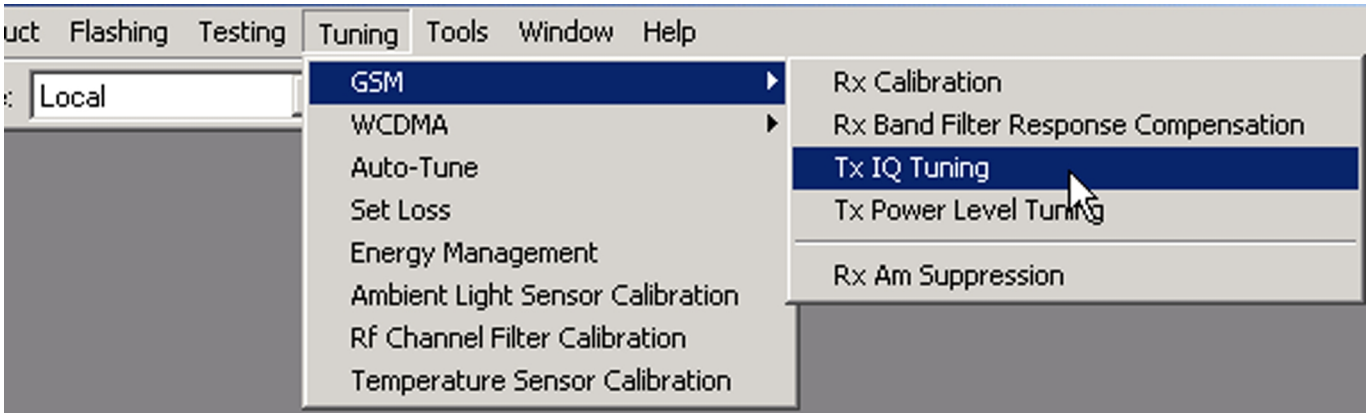
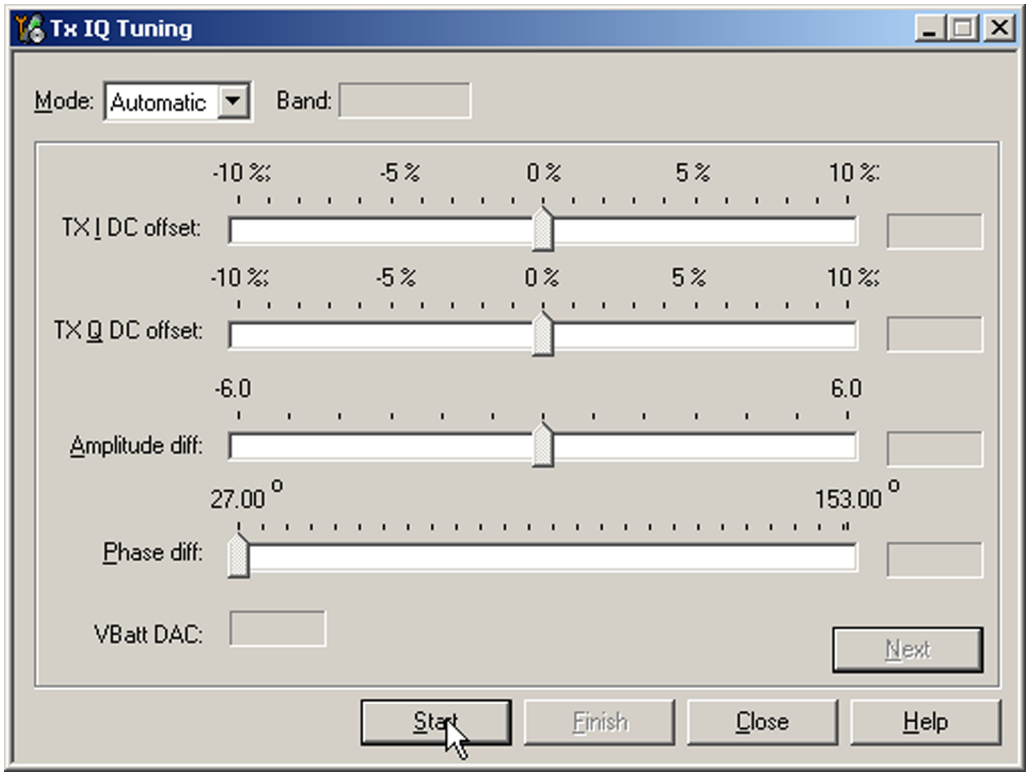
2. From the Tuning menu, choose GSM -> Tx IQ Tuning.



3. Set "Mode" to Automatic and "Edge" to Off.
4. Click Start.
   Wait until automatic tuning has finished and moved the sliders.
   Values are written to the phone memory automatically.



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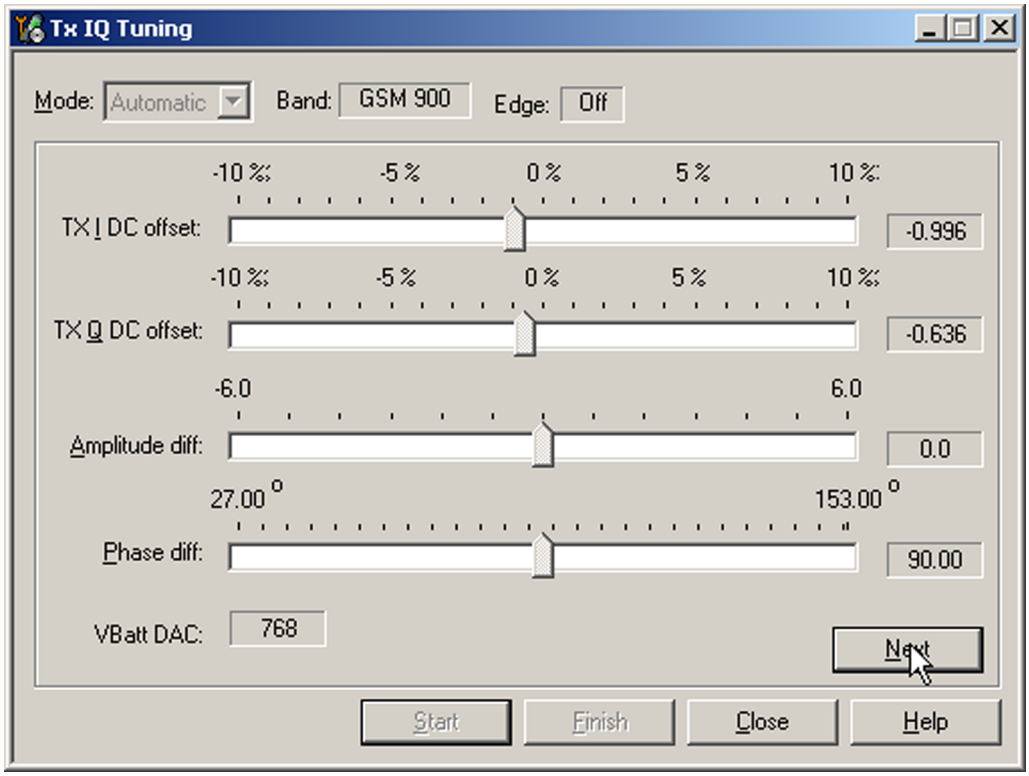
5. When the values have been written to the phone memory, click Next to change to the next band.



6. When all bands have been tuned, click Finish and Close to end the tuning procedure.

Next action

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850/GSM900				
I DC offset / Q DC offset	-6	-4 4	6	dB
Ampl	-1	0	1	dB
Phase	85	90	95	dB
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	dB
Ampl	-1	0	1	dB
Phase	95	100	110	dB

Tx power level tuning (GSM)

Context

Because of variations at IC process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

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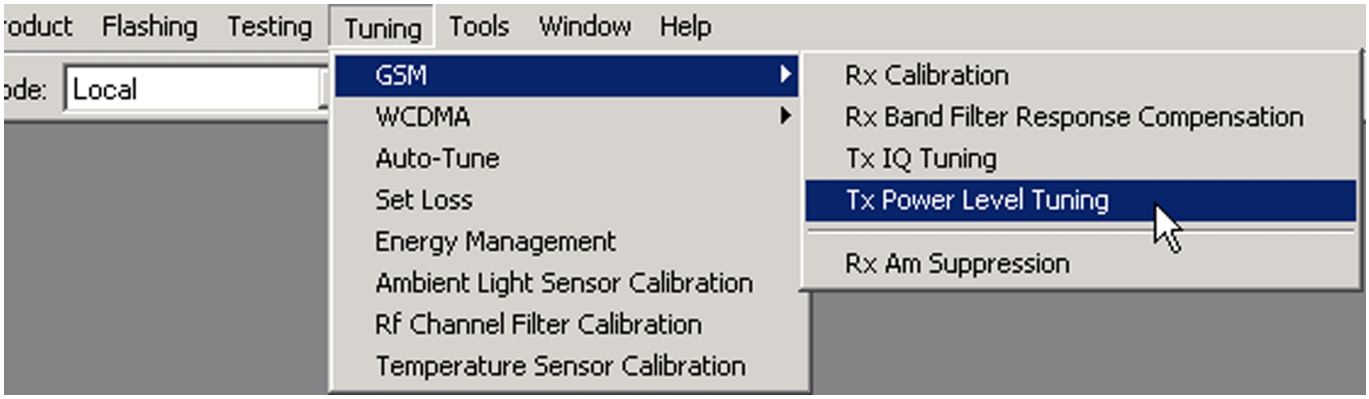
For EDGE transmission the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a power meter with peak power detector or Agilent VSA Transmitter Tester.
2. Start Phoenix service software.
3. From the "Operating mode" dropdown menu, set mode to "Local".
4. From the Tuning menu, choose GSM -> Tx Power Level Tuning.



5. If you are using an Agilent VSA use the settings in the table below.

Agilent VSA Transmitter Tester specific settings	
GSM850 Frequency (MHz)	836.6
GSM900 Frequency (MHz)	897.4
GSM1800 Frequency (MHz)	1747.8
GSM1900 Frequency (MHz)	1880
Resolution Bandwidth (MHz)	3
Video Bandwidth (MHz)	3
Trigger	Video
Sweeptime (ms)	1
Span	zero
Average (for non-EDGE)	10
Average (for EDGE)	50

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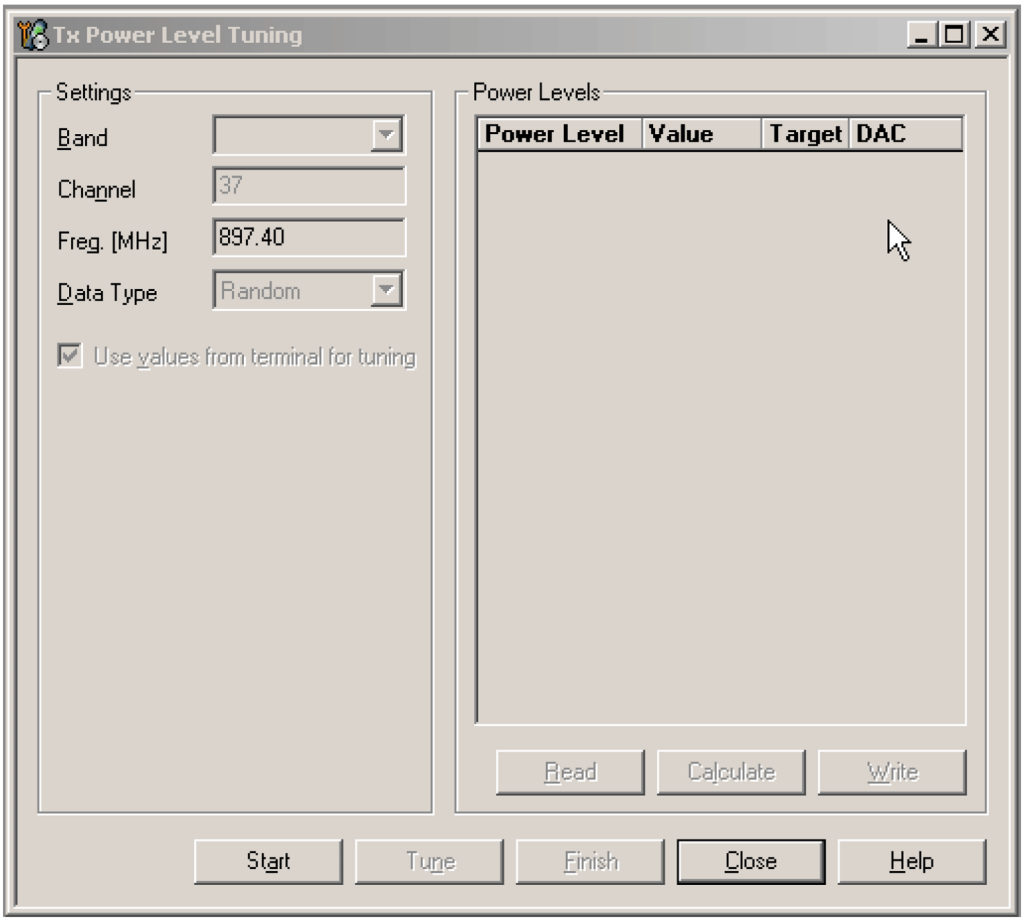
6. Click Start.



7. Select band. Set power meter or VSA to the correct frequency. Click Read and then Tune.

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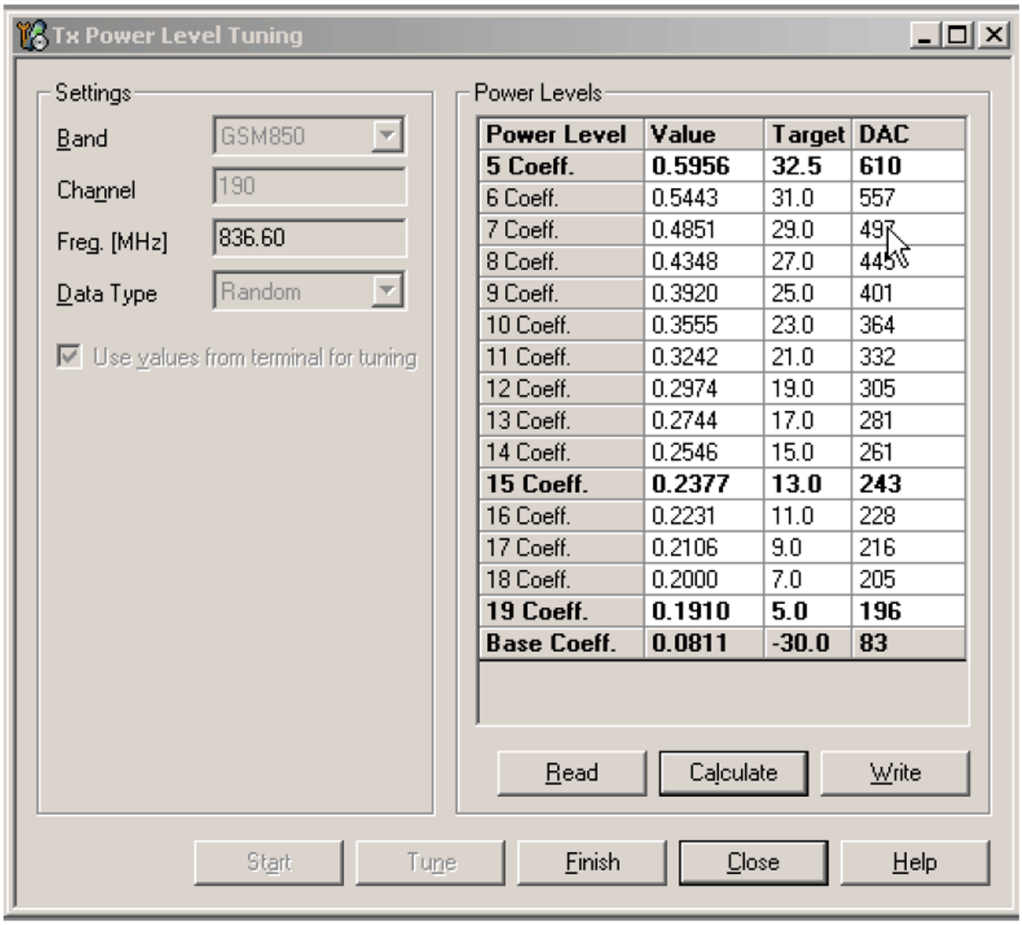
8. Adjust power levels **5**, **15** and **19** to correspond the "Target dBm" column by pressing + or – keys.



Check that the coeffiecient values are within the limits specified in the following table.

	Min	Typ	Max
GSM850			
PL5 coefficient	0.45	0.635	0.73
PL15 coefficient		0.238	
PL19 coefficient	0.12	0.185	0.3
GSM850 EDGE			
PL8 coefficient	0.35	0.466	0.6
PL15 coefficient		0.258	
PL19 coefficient	0.12	0.201	0.3
GSM900			
PL5 coefficient	0.45	0.648	0.73
PL15 coefficient		0.241	
PL19 coefficient	0.12	0.188	0.3
GSM900 EDGE			

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	Min	Typ	Max
PL8 coefficient	0.35	0.47	0.6
PL15 coefficient		0.261	
PL19 coefficient	0.12	0.203	0.3
GSM1800			
PL0 coefficient	0.45	0.597	0.7
PL11 coefficient		0.18	
PL15 coefficient	0.05	0.147	0.3
GSM1800 EDGE			
PL2 coefficient	0.35	0.446	0.6
PL11 coefficient		0.197	
PL15 coefficient	0.05	0.161	0.3
GSM1900			
PL0 coefficient	0.45	0.536	0.7
PL11 coefficient		0.19	
PL15 coefficient	0.05	0.158	0.3
GSM1900 EDGE			
PL2 coefficient	0.35	0.429	0.6
PL11 coefficient		0.208	
PL15 coefficient	0.05	0.175	0.3

9. If the values are within the limits, click "Calculate,Write & Finish". Repeat steps 7 to 9. for each band that needs tuning.
10. When tuning EDGE with the VSA use 50 averages and 10 averages for non-EDGE.
11. Tune EDGE power levels to the corresponding target power levels.

    Only power levels **8**, **15** and **19** are tuned in GSM850/GSM900 and **2**, **10** and **15** in GSM1800/1900.
12. When the tuning is completed, close the Tx Power Level Tuning window.

WCDMA receiver tunings

RX calibration (WCDMA)

Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500, RM-92, and is descreet with RF ASIC N7505, RM-91.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.

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2. In the **Tuning** menu, choose **WCDMA→Rx Calibration** .
3. Click **Start**.
4. Select Band "WCDMA 1900" for RM-91 and "WCDMA 2100" for RM-92.
5. Click **Tune**.
6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.

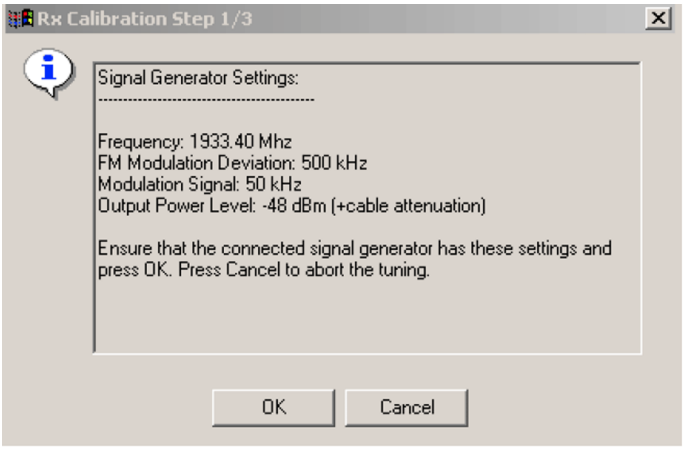

Figure 62 Pop-up window for WCDMA1900

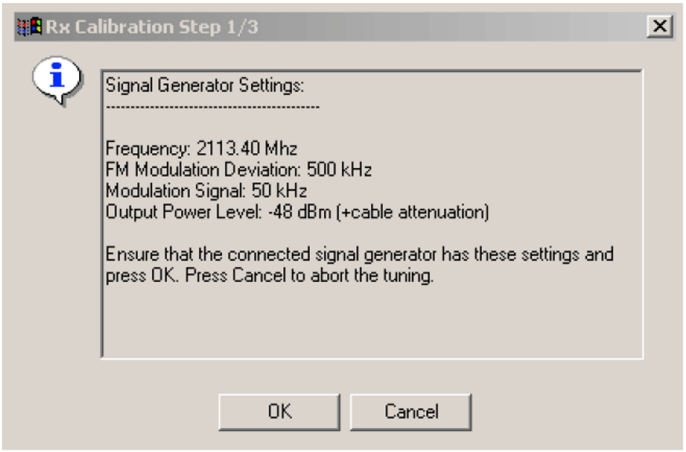

Figure 63 Pop-up window for WCDMA2100

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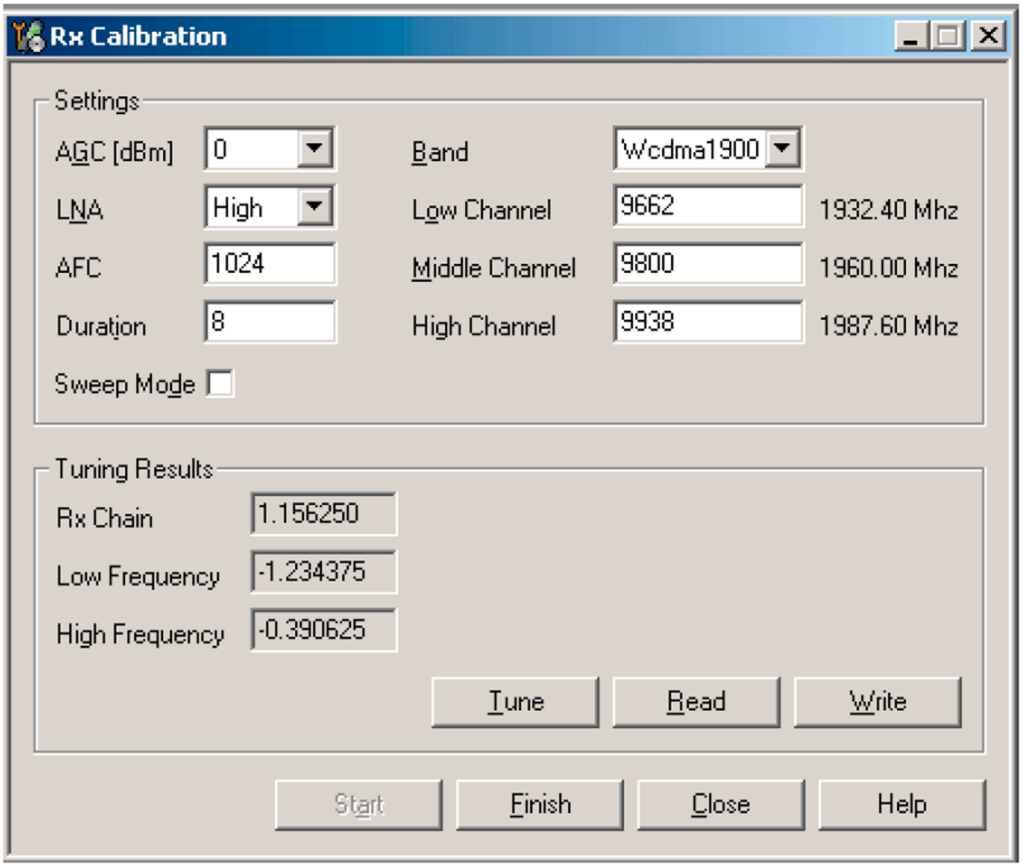
7. Repeat step 6. for Middle and High channels.



8. Ensure Tuning Results are within limits specified in the table below:
   If values are OK, click **Write** to save the values.

	Band	Min	Typ	Max	Unit
Rx chain	1900	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	
Rx chain	2100	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.
- In the **Tuning** menu, choose **WCDMA→ Rx Calibration** .
- Click **Start**.
- Select **Band**, "WCDMA 1900" for RM-91 or "WCDAM2100" for RM-92.

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- Check the **Sweep Mode** box.
- Click **Tune**.
- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.

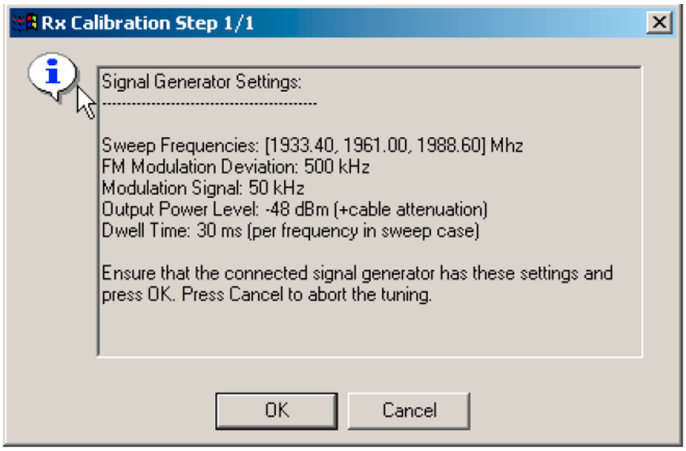

Figure 64 Pop-up window for WCDMA1900

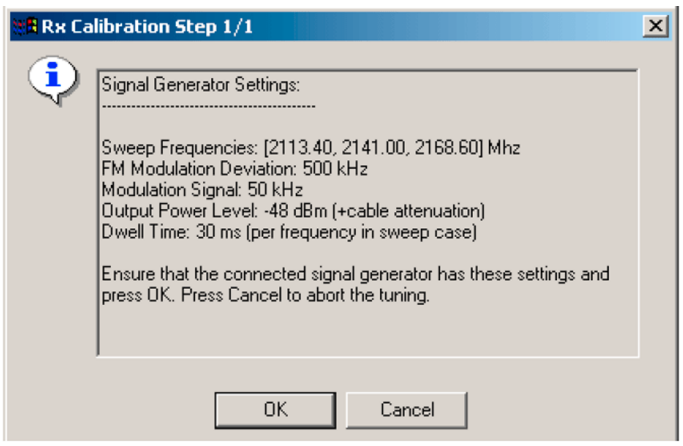

Figure 65 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.
- Close the tuning window.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

There are two ways to perform the tuning. For an alternative method, see Alternative steps (page 7–55).

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.

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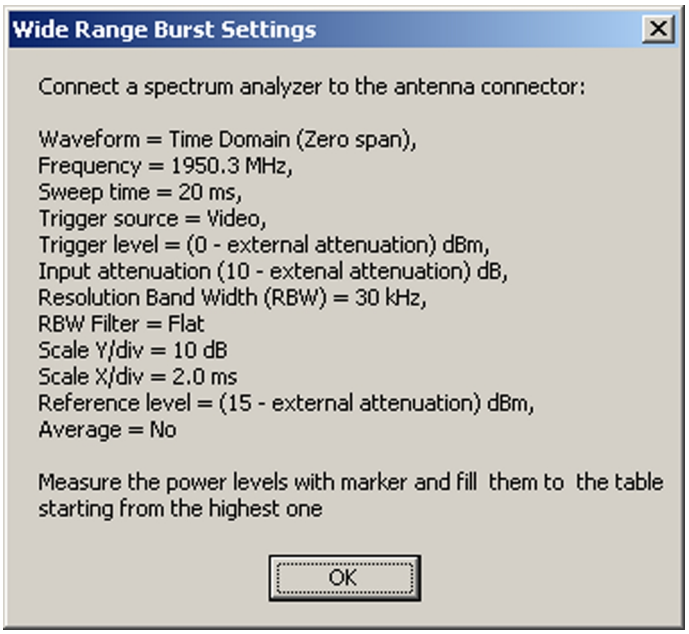
2. Choose **Tuning→WCDMA→Tx AGC & Power Detector.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).
5. Set up the spectrum analyzer in the following way:



6. After setting the spectrum analyzer, click **OK**.
7. Measure the power levels with a marker.

   Take the first measurement from 250 us after the trigger, the second from 750 us, the third on 1220 us and so on in every 500 us until the table is filled.

   Note: It must be possible to measure power levels down to –68 dBm. The measured power levels must be monotonously decreasing.

   Make sure that the marker is not measuring the level of noise spike on lower levels.

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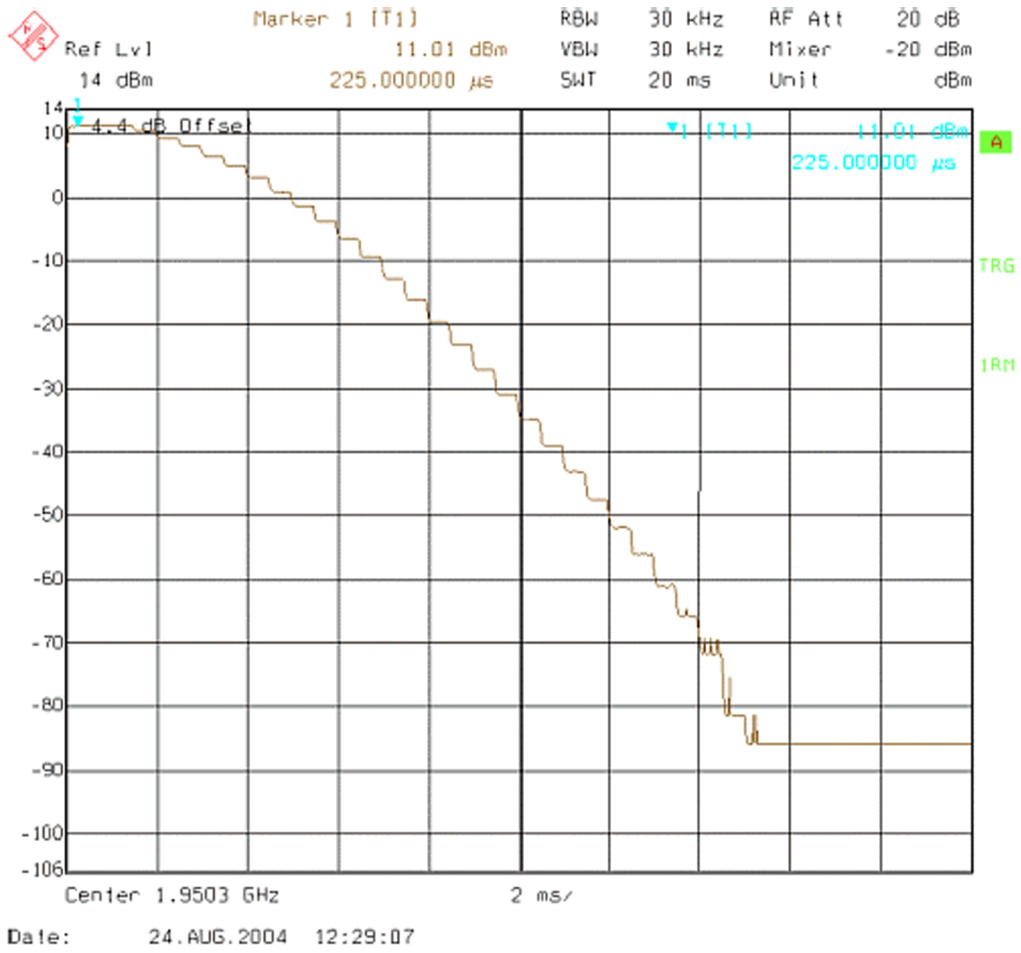

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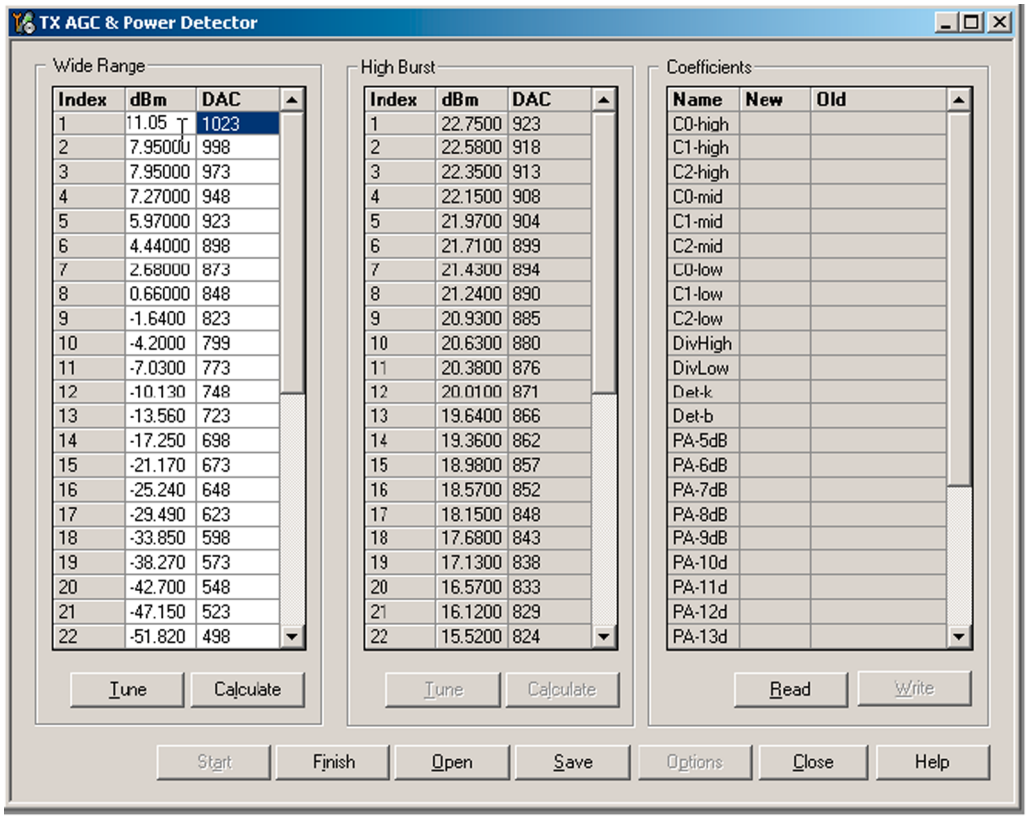
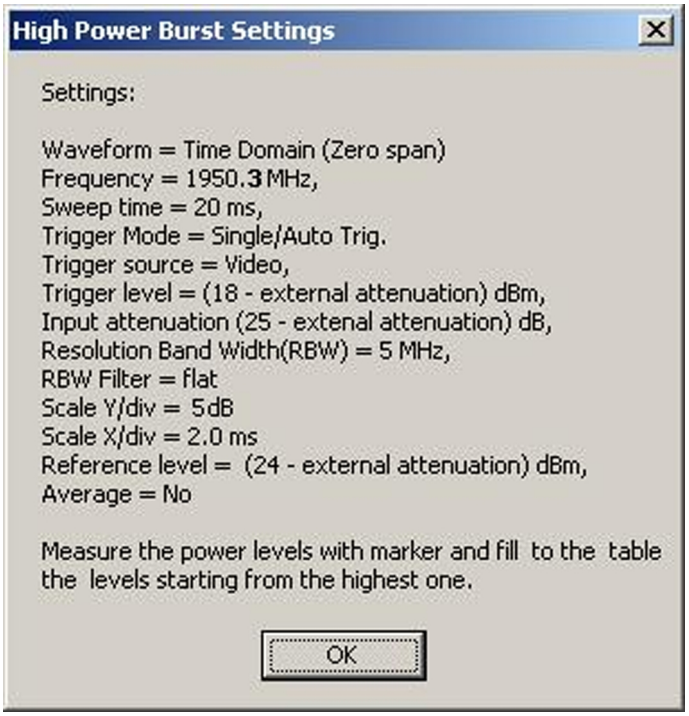
8. Fill in the power level values (in dBm) to the *Wide Range* table.



9. In the *Wide Range* pane, click **Calculate**.
10. In the *High Burst* pane, click **Tune**.
11. Adjust the spectrum analyzer according to the following settings:



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12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second from 750 us, third on 1220 us and so on in every 500 us until the table is filled.

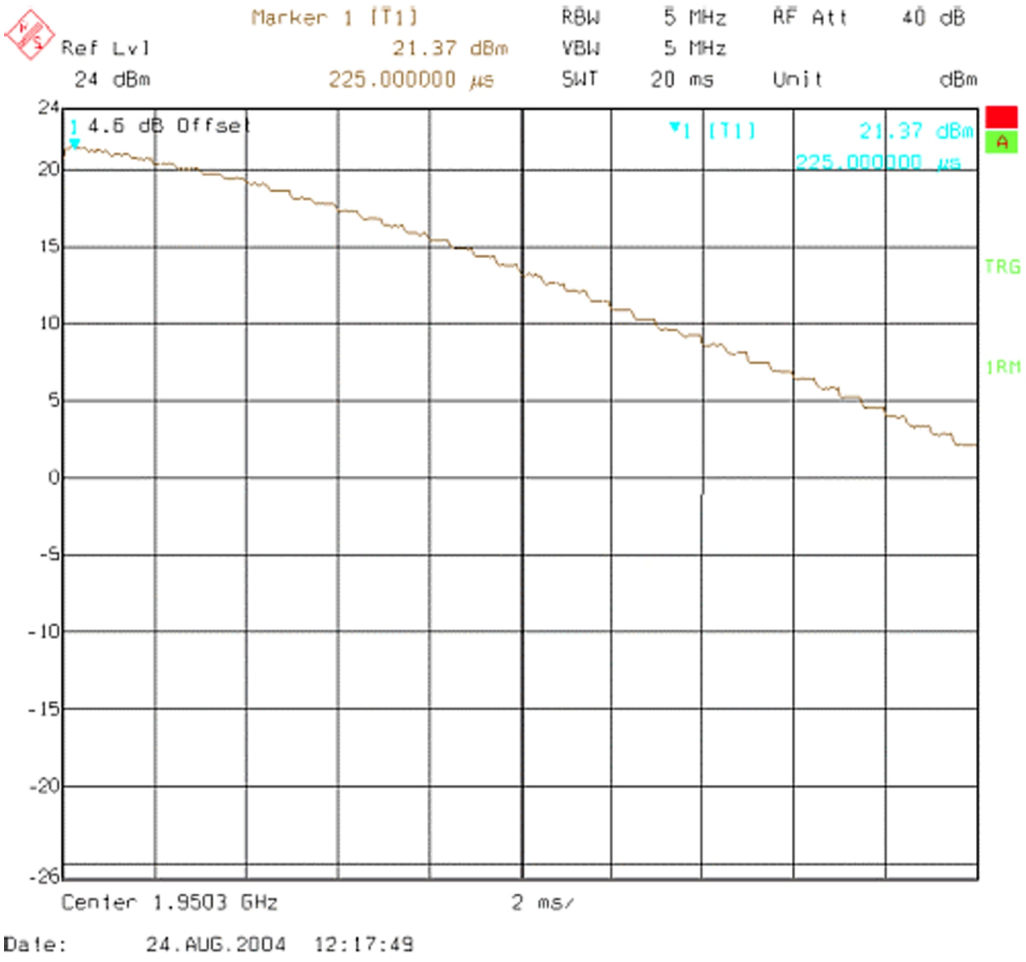

Figure 66 High burst measurement

13. In the *High Burst* pane, click **Calculate**.
14. Check that the calculated values are within the limits specified in the following table:

	Min	Max
C0-high	-0.5	5
C1-high	-50	50
C2-high	400	900
C0-mid	-0.7	0.7
C1-mid	0	50
C2-mid	400	900
C0-low	-4	4
C1-low	-400	440
C2-low	-10000	15000

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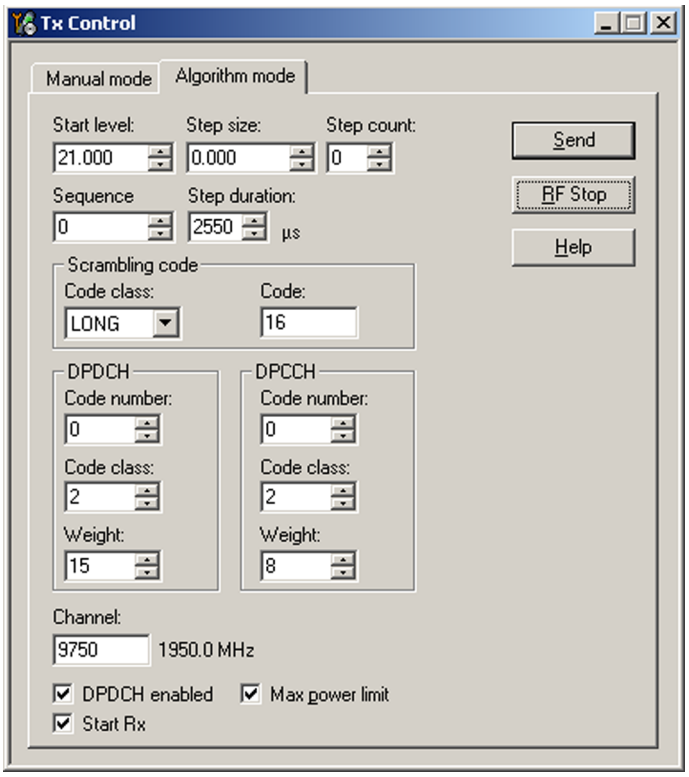
	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing→WCDMA→ Tx Control.**
18. Select the *Algorithm* mode tab.



19. Write the target power level 25 dBm to the *Start level* line and check the **Max power limit** check box (detector calibration check).
20. Setup the spectrum analyzer with the following settings:

Center frequency:	**1950.3 MHz**
Span:	0 Hz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	**24 dBm or -20 dBm depending on the level measured**
Input attenuation:	Automatic
Resolution bandwidth:	5 MHz
Video bandwidth:	5 MHz
Sweep time:	20 ms
Detector:	**RMS detector**

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Average:	No
Trigger:	Free run

21. Click **Send**.
22. Measure the WCDMA output power.

    It should be around 21 dBm.
23. Click **RF Stop** and uncheck the **Max power limit** check box.
24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

    The measured output power may not differ more than +-2 dB from the requested value at level +19 dBm and no more than +-4 dB on lower levels.

    Remember to stop the RF before sending new data.

Alternative steps

- Measure the wide range levels normally and write down the levels that are possible to measure.
- Click **Finish**.
- Click **Options**.
- Change the first wide range DAC value to *573* and change the number of tuning steps to *21*.
- Change the spectrum analyzer reference level to *–20* dBm and adjust the input attenuator to the lowest value possible.
- In the *Wide Range* pane, click **Tune** and fill in the rest of values starting from the 19th level.

Tx band response calibration (WCDMA)

Context

The purpose of this tuning operation is to calibrate the WCDMA Tx performance. It defines the power detector and Tx frequency compensation values. However, before starting this tuning procedure, it is necessary to carry out Tx AGC & Power Detector Calibration tuning. This is because its results will be needed for this tuning operation.

- In the *Tuning Settings* pane, it is possible to edit the numbers of channels used in this tuning operation.
- If the **Calibrate Detector Response** check box is checked, only Tx response is calibrated. Zero is written to the power detector compensation values block in the permanent memory (PM) of the terminal.
- **Detector Calibration level** shows the power level used for calibrating the power detector in this tuning procedure.
- **Tx Calibration level** shows the power level used for calibrating tx frequency in this tuning procedure.
- In *Measured Power Levels* pane, you can insert the dBm values read from the power meter.
- In *Tuned Values* pane, the values that are stored in the permanent memory (PM) of the terminal in Current columns are shown.
- New values are added to *New* column when the **Calculate** button is clicked.
- **Abort** button aborts the tuning operation without saving the tuned values.
- **Read** button reads the tuned values in the PM of the terminal, and displays them in the *Tuned Values* pane in in the *Current* column.

Steps

1. Start *Phoenix* service software.
2. Choose **File→Scan Product** .

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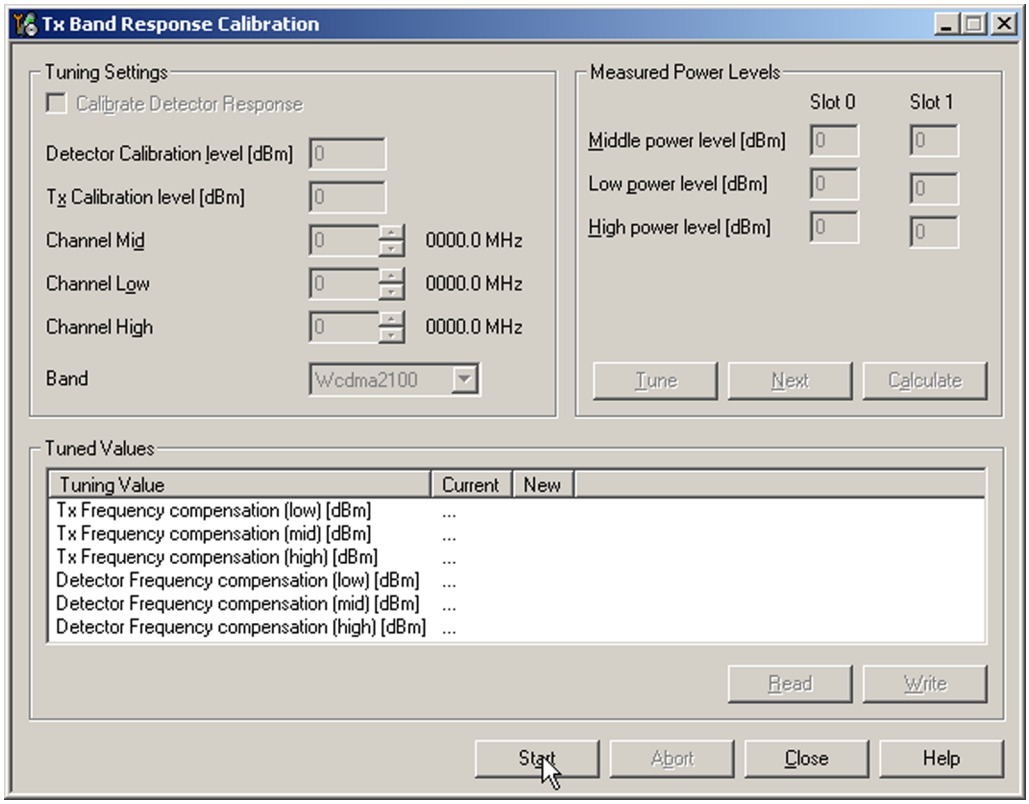
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→WCDMA→Tx Band Response Calibration** .
5. Click **Start**.



The current values are shown in the *Tuned Values* pane.

6. Click **Tune**.
7. Connect the power meter to the terminal, and set it to **Channel Mid** frequency.
8. Read the values of slot 0 and slot 1 from the power meter and enter them to **Middle power level** fields in the **Measured Power Levels** pane.

   Slot 0 is used for detector calibration and slot 1 for Tx calibration.
9. Click **Next**.
10. Switch the power meter to **Channel Low** frequency.
11. Read the values from the power meter, and enter them to **Low power level** fields.
12. Switch the power meter to **Channel High** frequency.
13. Read the values from the power meter, and enter them to **High power level** fields.
14. Click **Next**.
15. Click **Calculate**.

    The tuned values are shown in the *Tuned Values* pane in the *New* column.
16. Check that the tuned values are within the limits presented in the following table. If they are OK, click **Yes**.

	Min	Max
Tx Freq Comp (the first and last value)	-4	+4

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17. To save the tuned values to the terminal, click **Write**.
18. Close the *Tx Band Response Calibration* window.

Tx LO leakage (WCDMA)

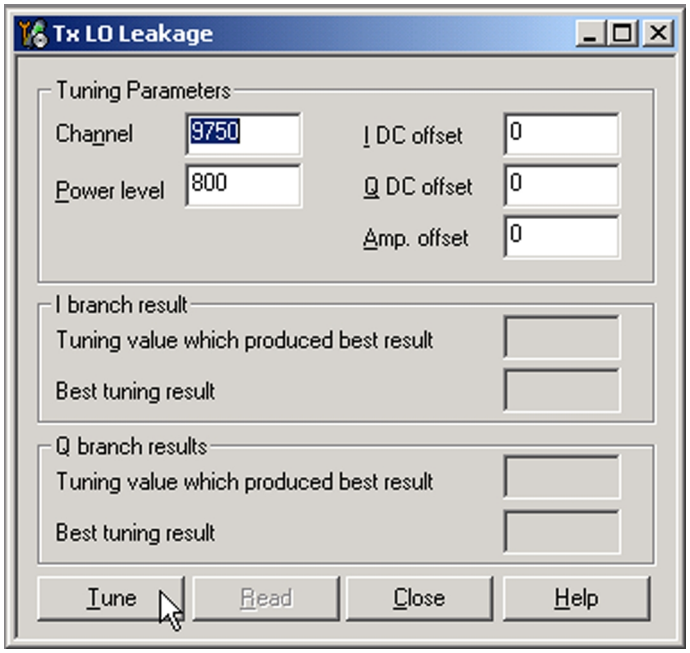
Context

The purpose of Tx LO leakage tuning is to minimize the carrier leakage of the IQ-modulator which is caused by the DC offset voltages in the Tx IQ-signal lines and in the actual IQ modulator.

The tuning improves WCDMA Tx AGC dynamics at low power levels. A self-calibration routine selects the best combination for internal control words in order to produce minimum LO leakage.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→WCDMA→ Tx LO Leakage** .
3. Click **Tune**.



4. To end the tuning, click **Close**.

WLAN transmitter troubleshooting

WLAN Tx tuning

Steps

1. From the *Tuning* menu choose **WLAN TX tuning**.
2. Press **Start**.

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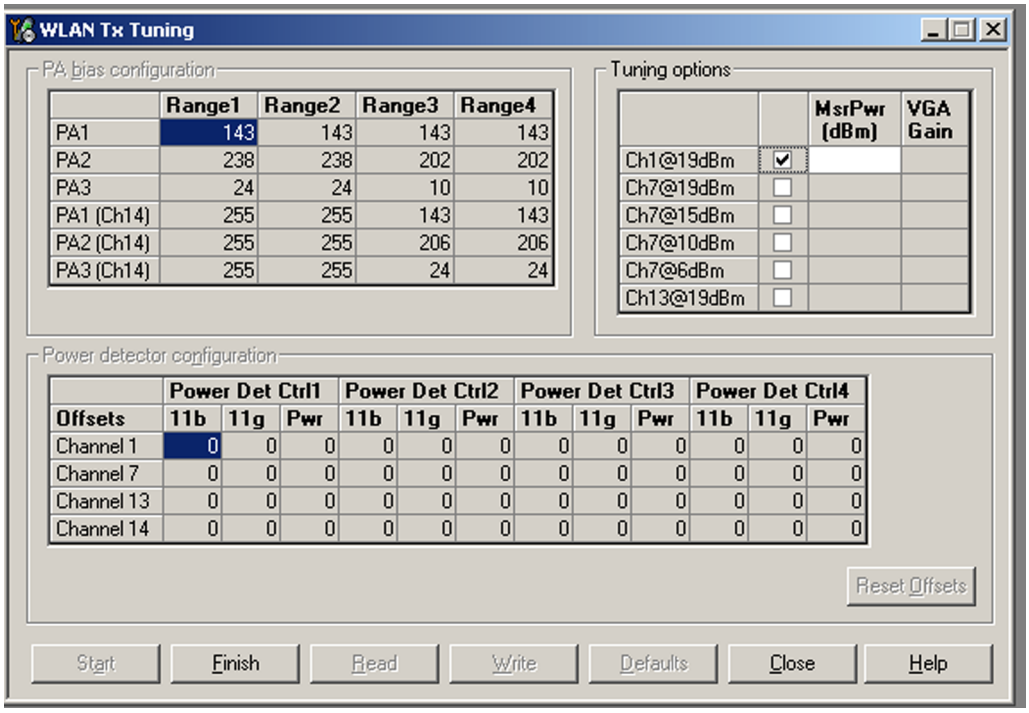
3. Tick the **Tuning options** Ch1@19dBm.



4. Measure power with power meter.
5. Place the power meter reading into Ch1@19dBm MsrPwr(dBm).
6. Repeat for all **Tuning options**.
7. Press **Finish**.

WLAN Tx tests

Steps

1. From *Testing* menu select **WLAN TX Tests**.

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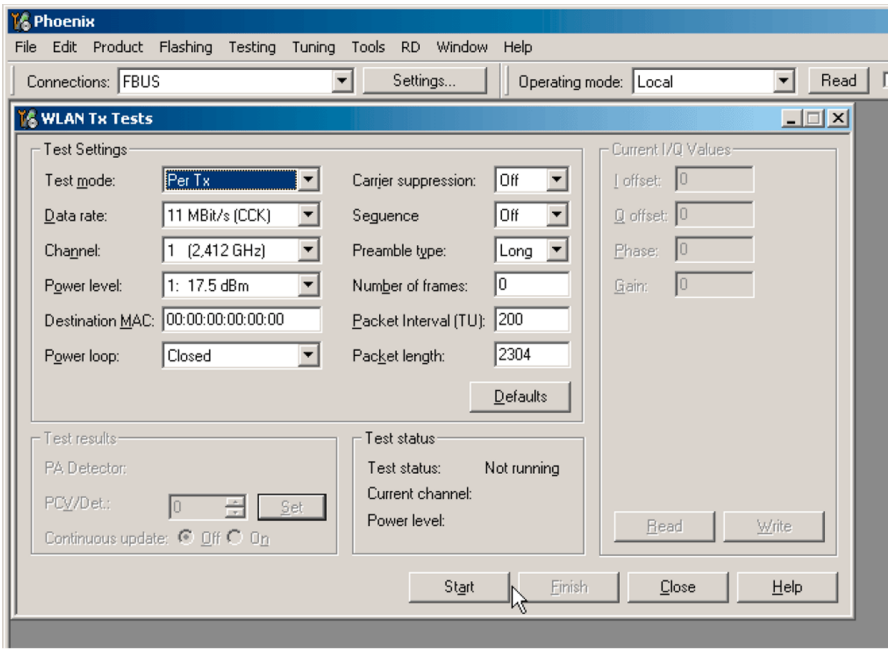
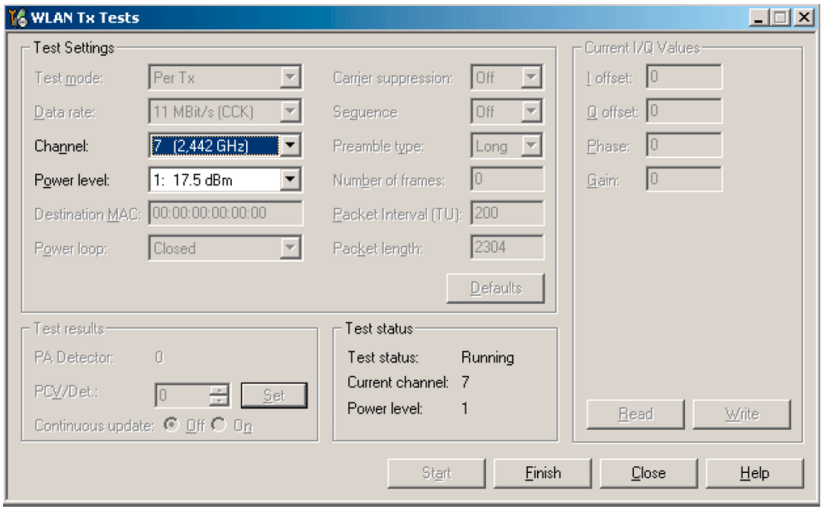
2. Make the selection as shown in the box below:



3. Press **Start**.
   Now you should see the following box:



4. Measure the ouput power via the WLAN/ BT RF connector with a power meter.
   For Power level 1: 17.5dBm, you shall see +16dBm (+/- 1dB).
5. Repeat steps 2 to 4 for the other power level.
   You shall see the following values:
   - Power output level 2 = 14dBm (+/- 1dB)
   - Power output level 3 = 9dBm(+/- 1dB)
   - Power output level 4 = 6dBm (+/- 1dB)
6. Now repeat the same exercise for Data Rate = 54Mbps.
   You shall see the following power levels:
   - Power output level 1 = 13dBm (+/- 1dB)

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- Power output level 2 = 13dBm (+/- 1dB)
- Power output level 3 = 8dBm (+/- 1dB)
- Power output level 4 = 5dBm (+/- 1dB)

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8 — Camera Module Troubleshooting

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Introduction to camera module troubleshooting

Background, tools and terminology

Faults or complaints in camera operation can be roughly categorised into three subgroups:

1 Camera is not functional at all; no image can be taken.

2 Images can be taken but there is nothing recognizable in them.

3 Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded.

Image quality is very hard to measure quantitatively, and even comparative measurements are difficult (comparing two images) to do, if the difference is small. Especially if the user is not satisfied with his/her device's image quality, and tells, for example, that the images are not sharp, it is fairly difficult to accurately test the device and get an exact figure which would tell whether the device is functioning properly.

Often subjective evaluation has to be used for finding out if a certain property of the camera is acceptable or not. Some training or experience of a correctly operating reference device may be needed in order to detect what actually is wrong.

It is easy for the user to take bad images in bad conditions. Therefore the camera operation has to be checked always in constant conditions (lighting, temperature) or by using a second, known-to-be good device as reference.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems may be expected to appear:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Terms

Dynamic range	Camera's ability to capture details in dark and bright areas of the scene simultaneously.
Exposure time	Camera modules use silicon sensor to collect light and for forming an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter image. The operation principle is exactly the same with silicon sensor, but the shutter functionality is handled electronically i.e. there is no mechanical moving parts like in film cameras.
Flicker	Phenomenon, which is caused by pulsating in scene lighting, typically appearing as wide horizontal stripes in an image.
Noise	Variation of response between pixels with same level of input illumination.
Resolution	Usually the amount of pixels in the camera sensor. In some occasions the term resolution is used for describing the sharpness of the images.
Sensitivity	Camera module's sensitivity to light. In equivalent illumination conditions, a less sensitive camera needs a longer exposure time to gather enough light in forming a good image. Analogous to ISO speed in photographic film.

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Sharpness	Good quality images are 'sharp' or 'crisp', meaning that image details are well visible in the picture. However, certain issues, such as non-idealities in optics, cause image blurring, making objects in picture to appear 'soft'. Each camera type typically has its own level of performance.

The effect of image taking conditions on image quality

There are some factors, which may cause poor image quality, if not taken into account by the end user when shooting images, and thus may result in complaints. The items listed are normal to camera operation and are not a reason for changing the camera module.

Distance to target

The lens in the module is specified to operate satisfactorily from 68 cm to infinite distance of scene objects in hyper-focal position, and 17.5 to 23.4 in the macro mode.

To use the camera in hyper-focal mode, the macro mode switch situated in the camera bezel beneath the camera window must be locked into the right hand position indicated by the mountain icon. To use the macro mode, the switch must be locked in the left hand position indicated by the tulip (macro) icon. If the switch is not locked in hyper-focal or macro position and set to an intermediate center position, the sharpness of the image will be degraded. In practice, the operation is such that close objects may be noticed to get more blurred when distance to them is shortened from 48 cm. Lack of sharpness is first visible in full resolution (2048 * 1536) images. If observing just the viewfinder, even very close objects may seem to appear sharp. This is normal; do not change the camera module.

Figure 67 Blurred image. Target too close.

The amount of light available

In dim conditions camera runs out of sensitivity. The exposure time is long (especially in the night mode) and the risk of getting shaken (= blurred) images increases. In addition, image noise level grows. The maximum exposure time in night mode increases, therefore, images need to be taken with extreme care and by supporting the phone when the amount of light reflected from the target is low. Because of the longer exposure time and larger gain value, noise level increases in low light conditions. Sometimes blurring may even occur in daytime, if the image is taken very carelessly. See the figure below for an example. This is normal; do not change the camera module.

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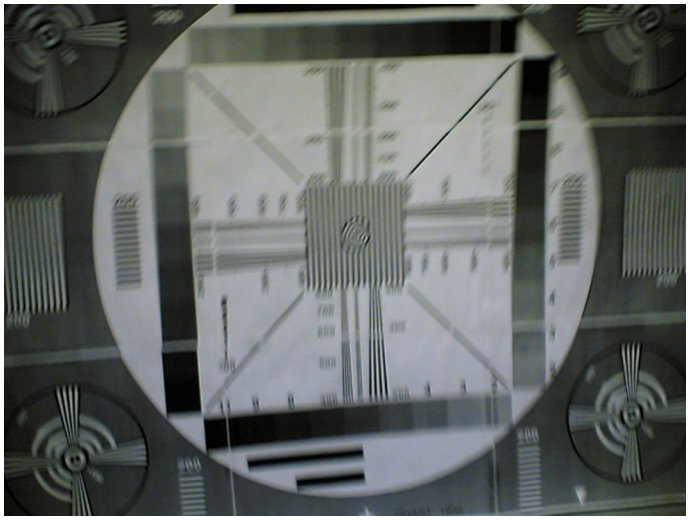

Figure 68 Blurring caused by shaking hands

Movement in bright light

If an image is taken of moving objects or if the device is used in a moving vehicle, object 'skewing' or 'tilting' may occur. This phenomenon is fundamental to most CMOS camera types, and usually cannot be avoided. The movement of camera or object sometimes cause blurring indoors or in dim lighting conditions because of long exposure time. This is normal; do not change the camera module.

Figure 69 Near objects get skewed when taking images from a moving vehicle

Temperature

High temperatures inside the mobile phone cause more noise to appear in images. For example, in >40 degrees (Celsius) ambient, the noise level may increase and it further grows if the conditions are dim. If the phone transmitter has been running at full power or the processor has been heavily loaded for a long time before image taking, the temperature inside the phone might be considerably higher than the temperature in the surrounding environment. This is normal to camera operation, do not change the camera module.

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Figure 70 Noisy image taken in +70 degrees Celsius

Phone display

If the display contrast is set too dark, the image quality degrades: the images may be very dark depending on the setting. If the display contrast is set too bright, image contrast appears bad and "faint". This problem is solved by setting the display contrast correctly. This is normal behaviour; do not change the camera module.

Basic rules of photography (especially shooting against light)

Because of dynamic range limitations, taking images against bright light might cause either saturated image or the actual target appear too dark. In practice, this means that when taking an image indoors and having, for example, a window behind the object, the result is usually poor. This is normal behaviour; do not change the camera module.

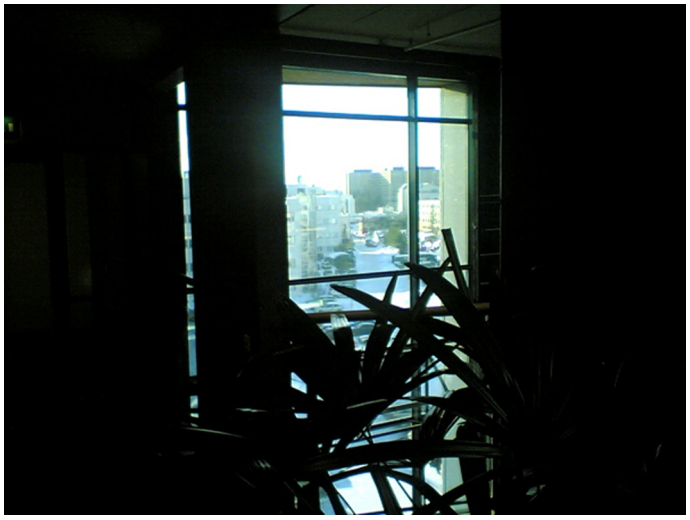

Figure 71 Image taken against light; the actual object is dark

Flicker

In some occasions a bright fluorescent light may cause flicker in the viewfinder and captured image. This phenomenon may also be a result, if images are taken indoors under the mismatch of 50/60 Hz electricity network frequency. The electricity frequency used is automatically detected by the camera module. In some very few countries, both 50 and 60 Hz networks are present and thus probability for the phenomenon increases. Flickering occurs also under high artificial illumination level. This is normal behaviour; do not change the camera module.

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Figure 72 Flicker in an image; uniform object illuminated by strong fluorescent light

Bright light outside of image view

Especially the sun can cause clearly visible lens glare phenomenon and poor contrast in images. This happens because of undesired reflections inside the camera optics. Generally this kind of reflections are common in all optical systems. This is normal behaviour; do not change the camera module.

Figure 73 A lens reflection effect caused by sunshine

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Examples of good quality images

Figure 74 Good image taken indoors

Figure 75 Good image taken outdoors

Image quality analysis

Testing for dust in camera module

Symptoms and diagnosis

For detecting dust problems, take an image of a uniform white surface and analyse it in full resolution. A good quality PC CRT monitor is preferred for analysis (avoid using LCD). Search carefully because finding these defects is not always easy. Figure "Effects of dust on optical path" is an example of an image having easily detectable dust problems.

When taking a white image, use uniformly lightened white paper or white wall. Another option is to use uniform light but in this case make sure that the camera image is not flickering when taking the test image. In case flickering occurs, try to reduce the illumination level. Use JPEG image format for analysing, and set the image quality parameter to ‘High Quality’.

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Black spots in an image are caused by dirt particles trapped inside the optical system. Clearly visible and sharp edged black dots in an image are typically dust particles on the image sensor. These spots are searched for in the manufacturing phase, but it is possible that the camera body cavity contains a particle, which may move onto the image sensor active surface, for example, when the phone is dropped. Therefore it is also possible that the problem will disappear before the phone is brought to service. The camera should be replaced if the problem is present when the service technician analyses the phone.

If dust particles are lying on the infrared filter surface on either side, they are hard to locate because they are out of focus, and appear in the image as large, grayish and fading-edge 'blobs'. Sometimes they are invisible to the eye, and the user probably does not notice them at all. However, it is possible that a larger particle disturbs the user, causing need for service.

Figure 76 Effects of dust on optical path

If large dust particles get trapped on top of the lens surface in the cavity between the camera window and the lens, they will cause image blurring and poor contrast. The dust gasket between the window and lens should prevent any particles from getting into the cavity after the manufacturing phase.

If dust particles are found on the sensor, this is classified as a manufacturing error of the module, and the camera should be replaced. Any particles inside the cavity between the protection window and the lens have most probably been trapped there in the assembly phase at a Nokia factory. Unauthorized disassembling of the product can also be the root of the problem. However, in most cases it should be possible to remove the particle(s) by using clean compressed air. Never wipe the lens surface before trying compressed air; the possibility of damaging the lens is substantial. Always check the image sharpness after removing dust.

Testing camera image sharpness

Symptoms and diagnosis

If pictures taken with a device are claimed to be blurry, there are six possible sources for the problem:

1 The protection window is fingerprinted, soiled, dirty, visibly scratched or broken.

2 The photographed object is too close – the camera lens operates with distances from 60 cm to infinity – or incorrect mode is selected using macro switch. This is no cause to replace camera module.

3 User has tried to take pictures in too dark conditions, and images are blurred due to handshake or movement. This is no cause to replace camera module.

4 There is dirt between the protection window and camera lens.

5 The protection window is defective. This can be either a manufacturing failure or caused by the user. The window should be changed.

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6 The camera lens is misfocused because of a manufacturing error.

A quantitative analysis of sharpness is very difficult to conduct in any other environment than optics laboratory. Therefore, subjective analysis should be used.

If no visible defects (items 1-4) are found, a couple of test images should be taken. Generally, a well-illuminated typical indoor scene can be used as a target. The main considerations are:

- The protection window has to be clean.
- The amount of light (300 – 600 lux (bright office lighting)) is sufficient.
- The scene should contain, for example, small objects for checking sharpness. Their distance should be 1 – 2 meters.
- If possible, compare the image to another image of the same scene, taken with a different device. Note that the reference device has to be a similar Nokia phone.

Steps

1. Take several images of small objects in the distance of 1-2 metres.
2. Analyse the images on a PC screen at 100% scaling with the reference images.

   Pay attention to the computer display settings: at least 65000 colors (16-bit) have to be used. 256 (8-bit) color setting is not sufficient, and true color (24 bit, 16 million colors) or 32 bit (full color) setting is recommended.

Next action

If there appears to be a clearly noticeable difference between the reference image and the test images, the module might have a misfocused lens -> change the module.

Re-check the resolution after changing the camera module.

If the changed module produces the same result, the fault is probably in the camera window. Check the window by looking carefully through it when replacing the module.

Dirty camera lens protection window

The following series of images demonstrates the effects of fingerprints on the camera protection window.

It should be noted that the effects of any dirt in images can vary much. It may be difficult to judge whether the window has been dirty or if something else is wrong. Therefore, the cleanness of the protection window should always be checked and the window should be wiped clean with a suitable cloth.

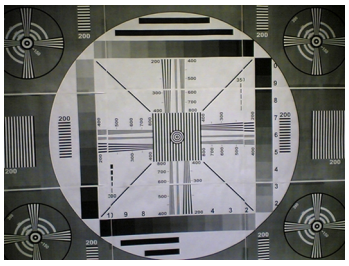

Figure 77 Image taken with clean protection window

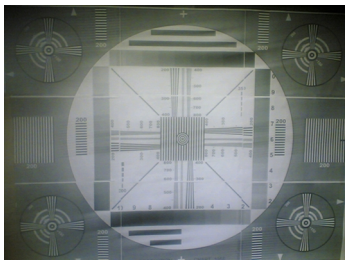

Figure 78 Image taken with greasy protection window

Image bit errors

Bit errors are image defects caused by data transmission errors between the camera module and the phone baseband and/or errors inside the module.

Usually bit errors can be easily detected in images, and they are best visible in full resolution images. A good practice is to use a uniform white test target when analysing these errors. The errors are clearly visible, colourful sharp dots or lines in camera images. See the following figure.

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Figure 79 Bit errors caused by JPEG compression

One type of bit error is a lack of bit depth. In this case, the image is almost totally black under normal conditions, and only senses something in very highly illuminated environments. Typically this is a contact problem between the camera module and the phone main PWB. You should check the camera assembly and connector contacts.

If the fault is in the camera module, bit errors are typically visible only when using some specific image resolution. For example, in case of a viewfinder fault, the error might exist but is not visible in a full size image.

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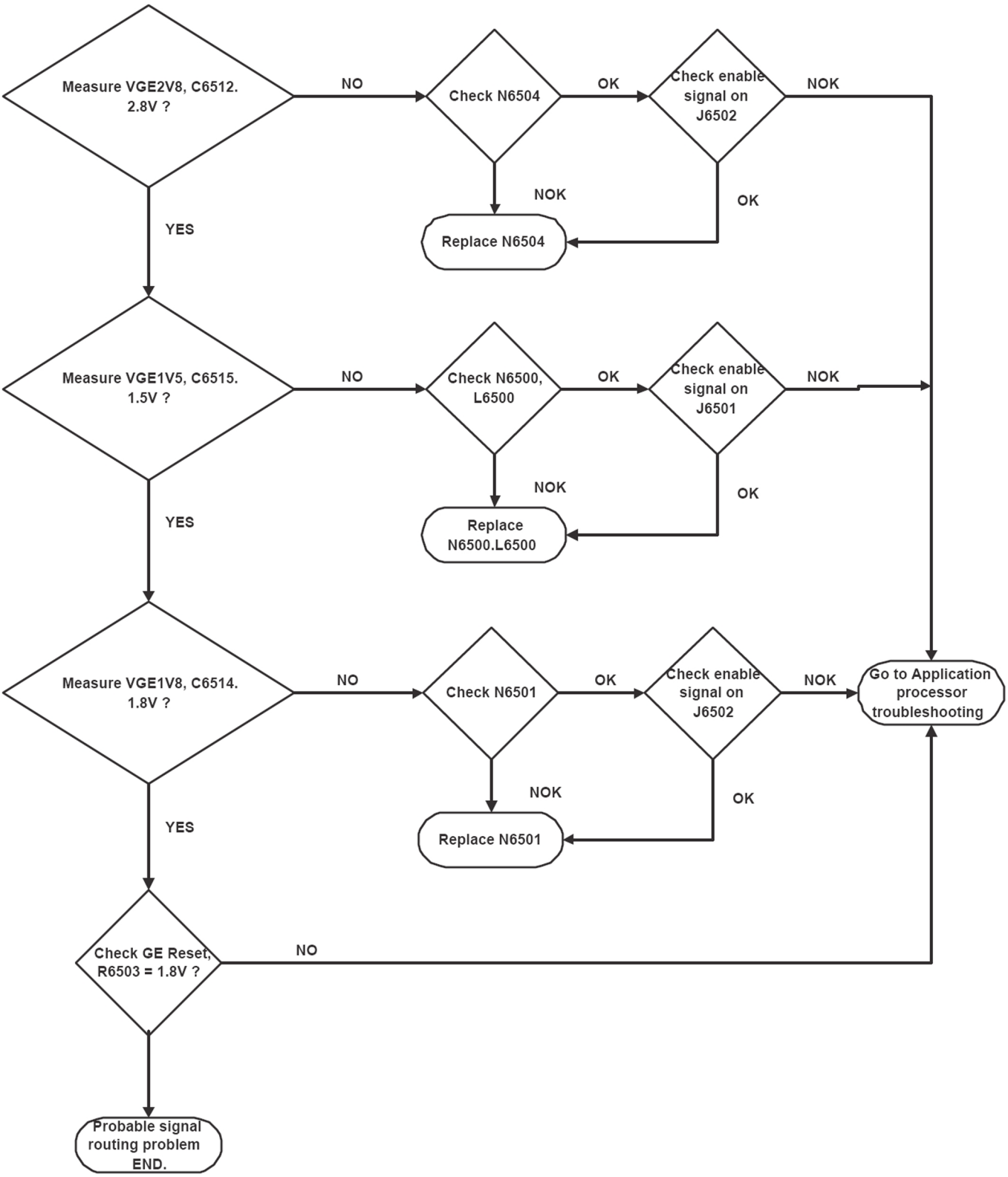
Camera troubleshooting flowcharts

Main camera troubleshooting flowchart

Troubleshooting flow



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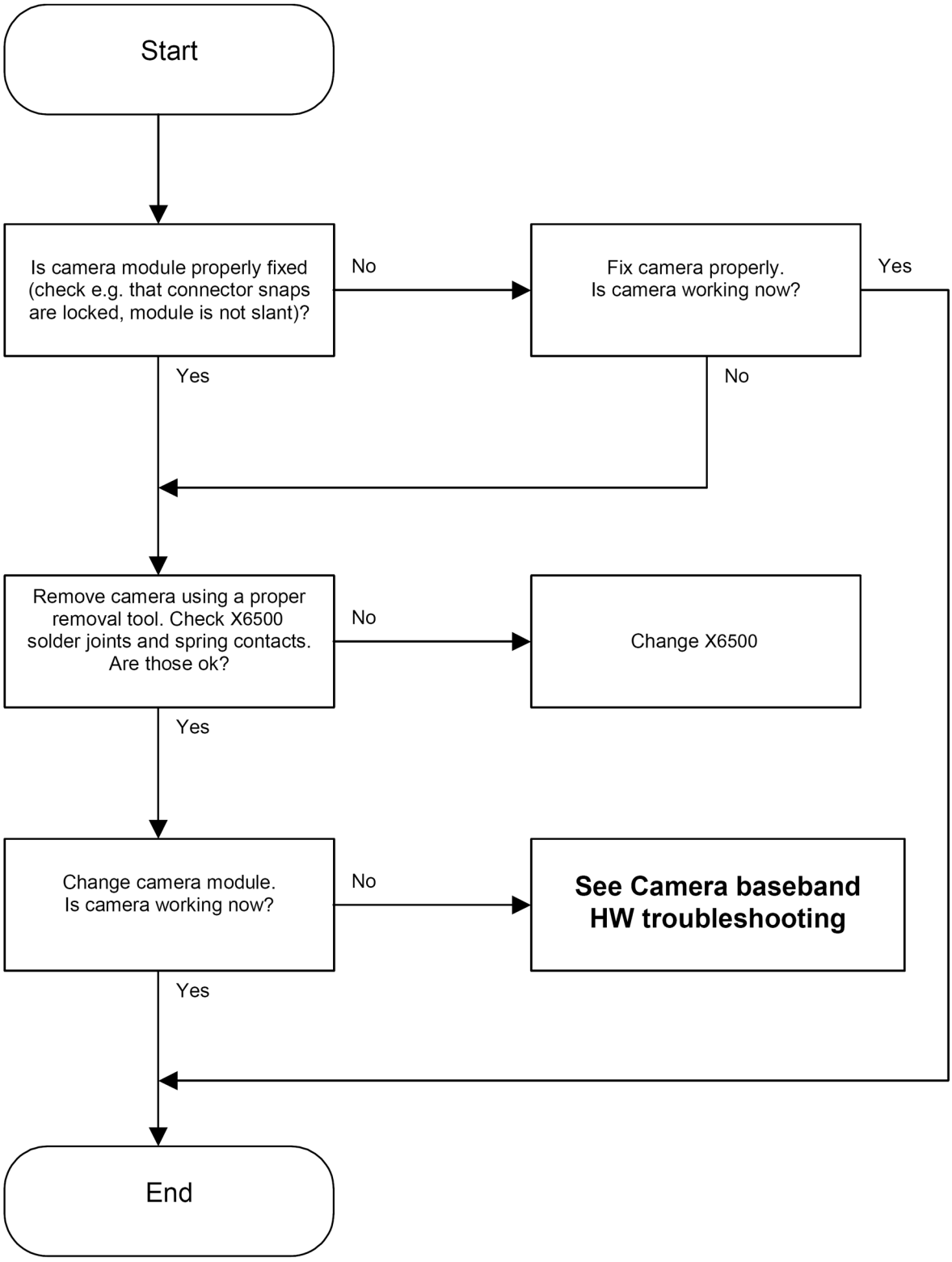
Back camera troubleshooting

Camera hardware failure message troubleshooting

Troubleshooting flow



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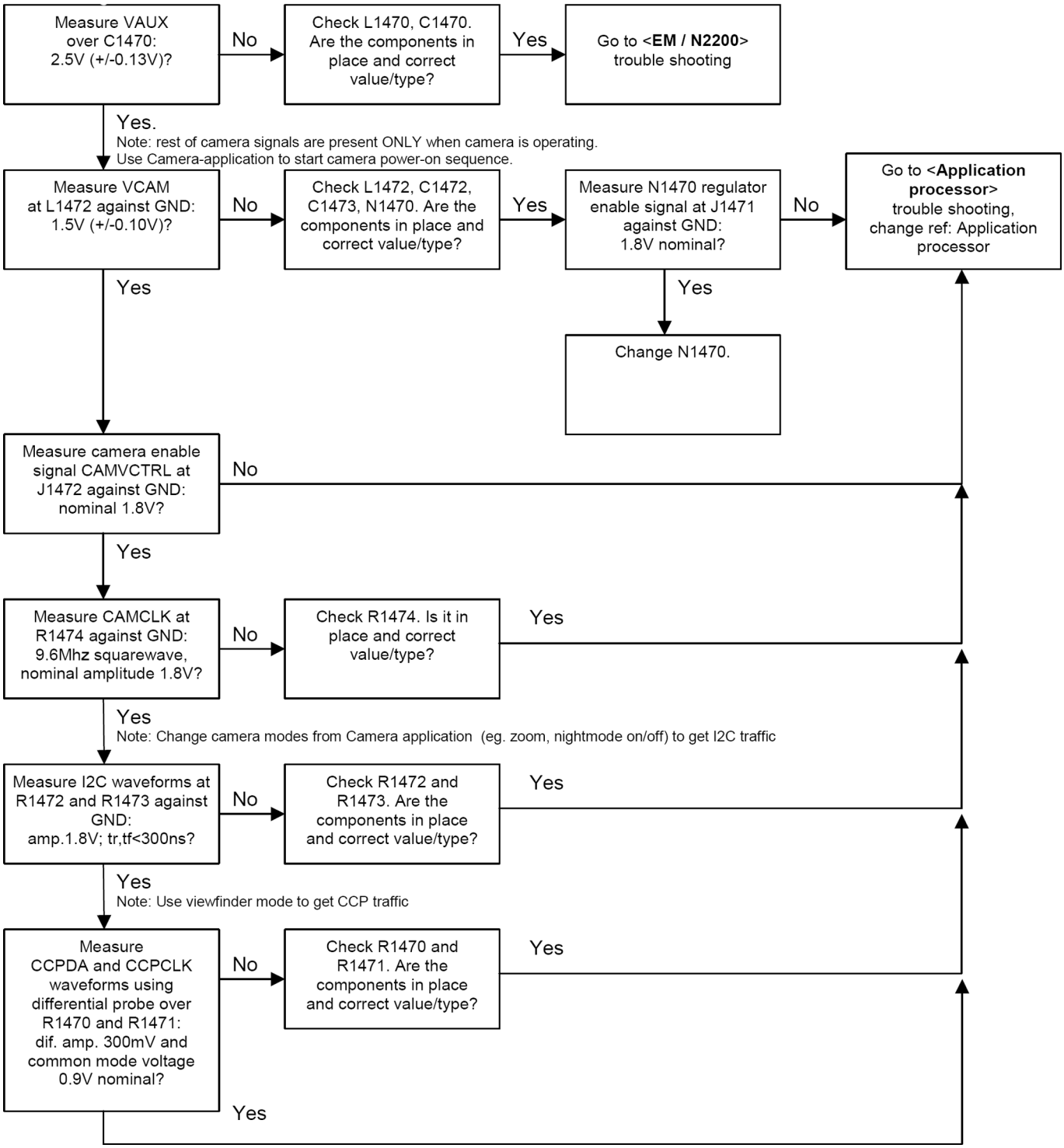
Note: Make sure that the phone has the latest software before continuing.

Camera baseband HW troubleshooting

Troubleshooting flow



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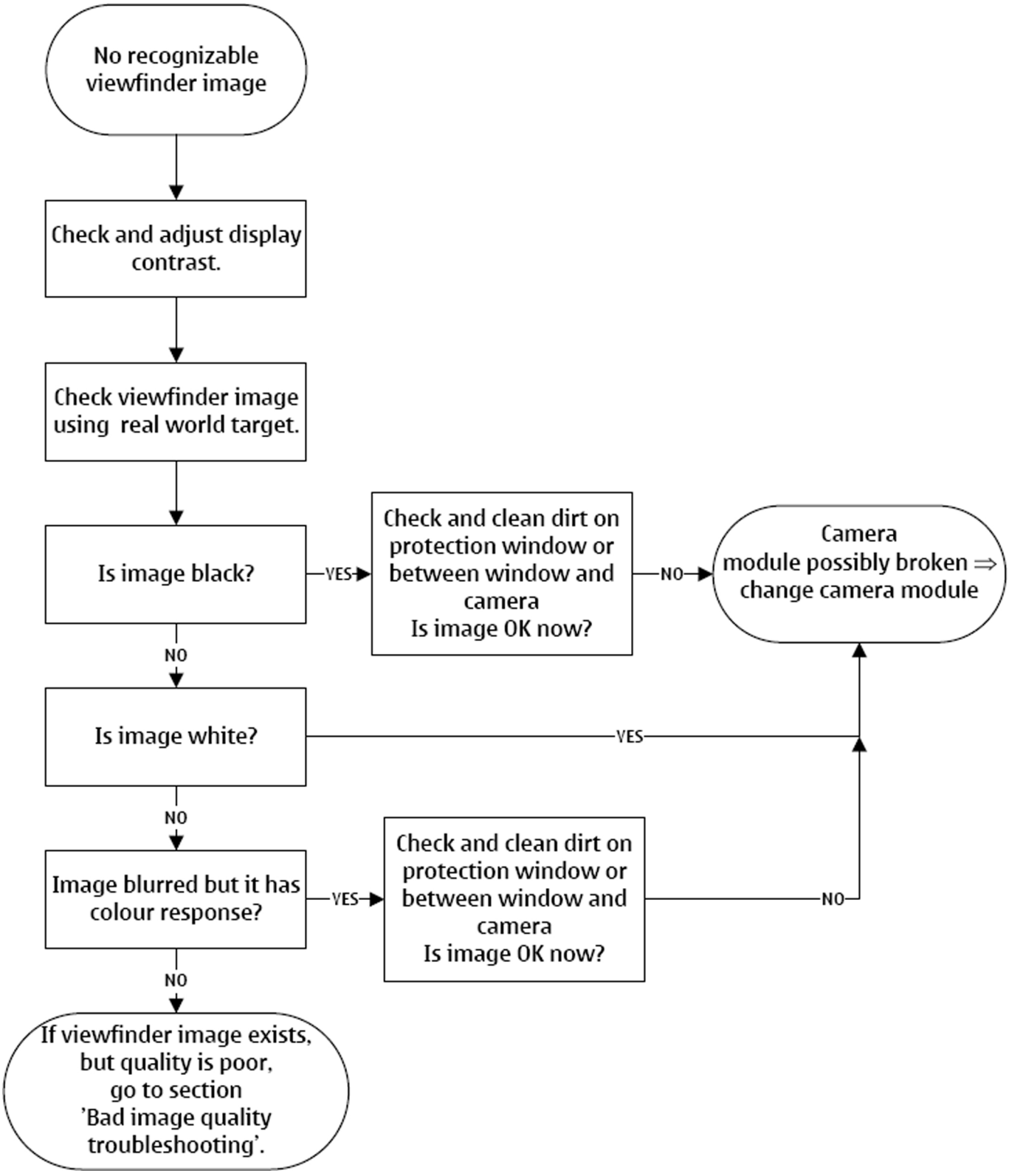
Camera viewfinder troubleshooting

Troubleshooting flow



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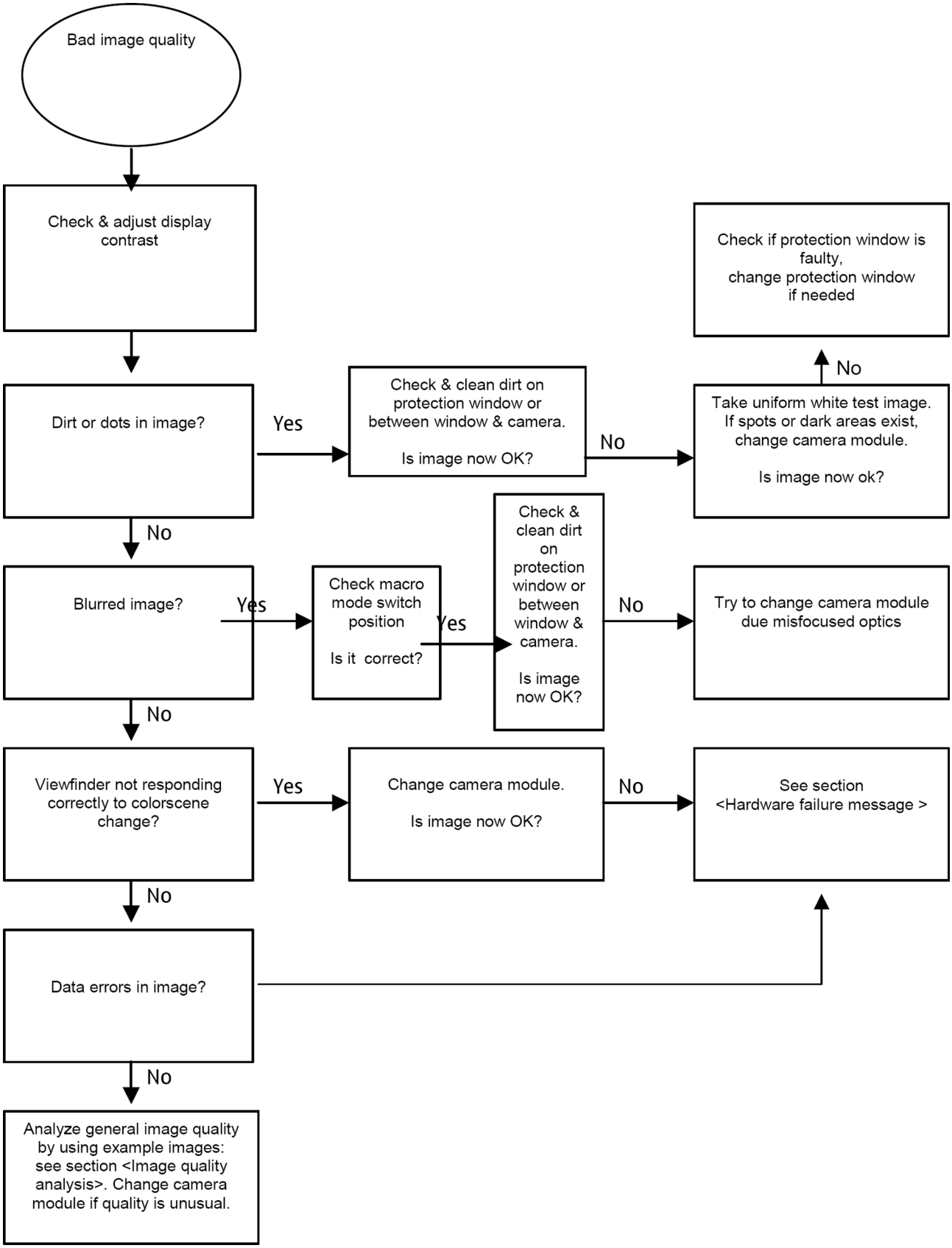
Bad camera image quality troubleshooting

Troubleshooting flow



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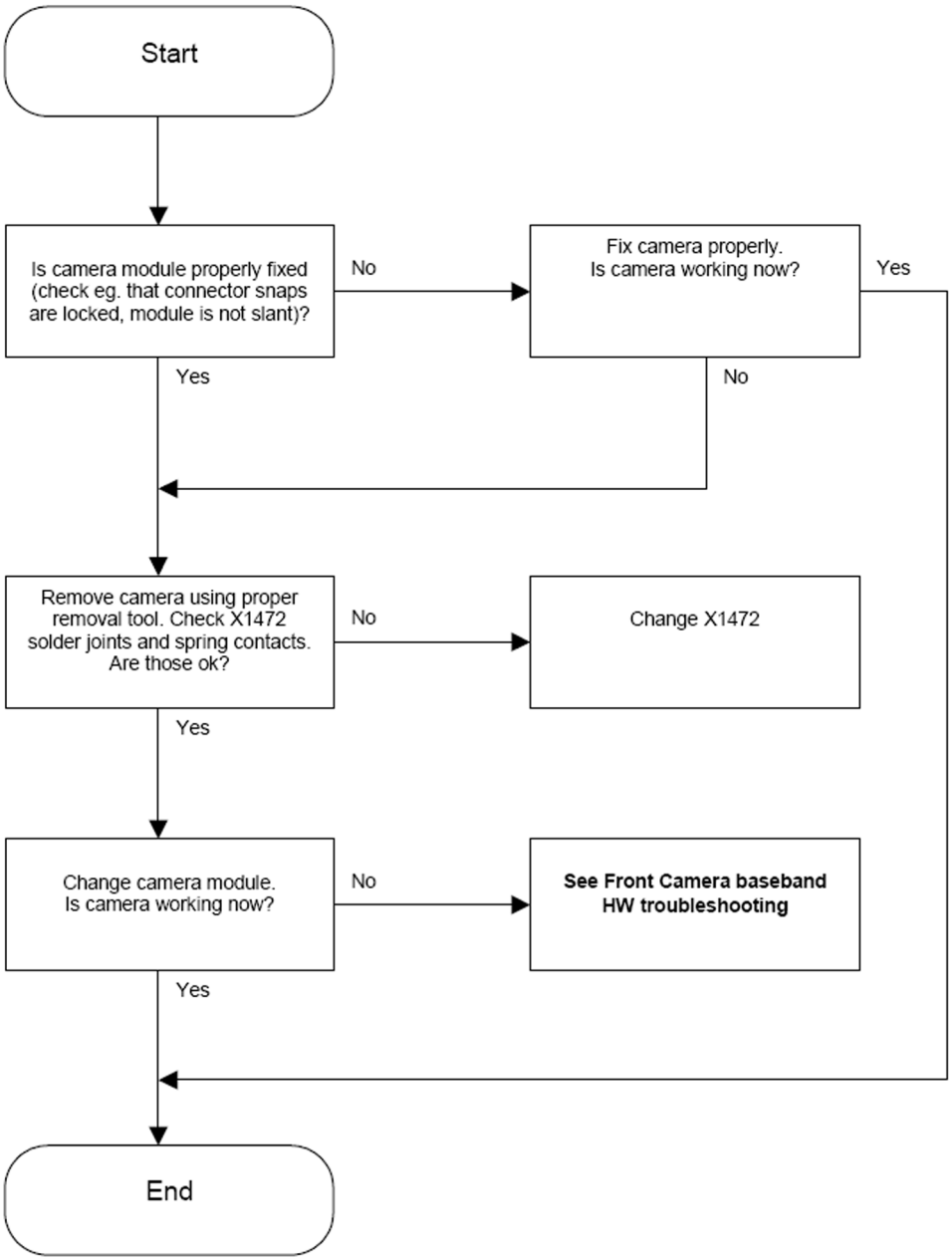
Front camera troubleshooting

Front camera hardware failure message troubleshooting

Troubleshooting flow



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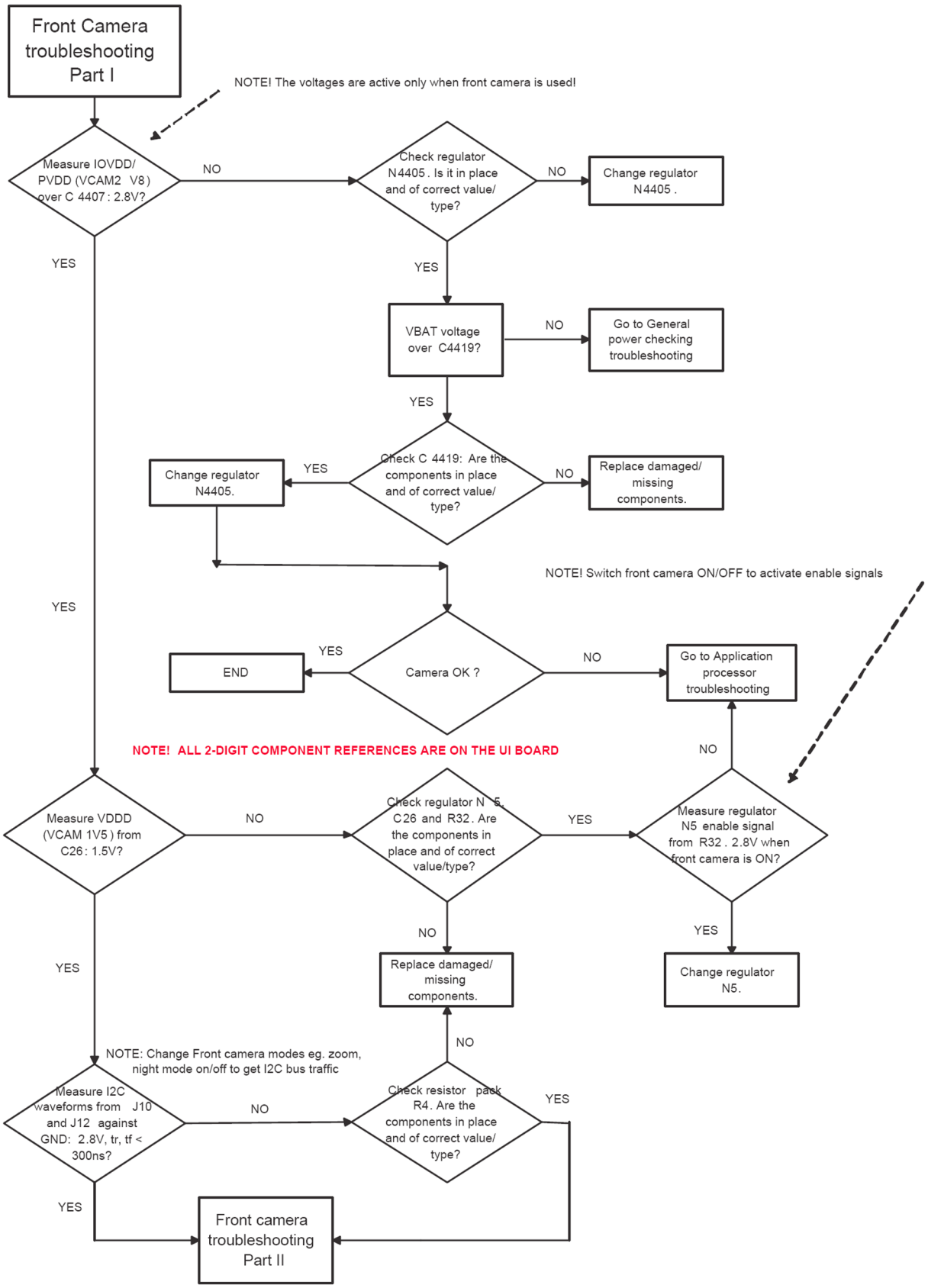
Front camera HW baseband troubleshooting

Troubleshooting flow



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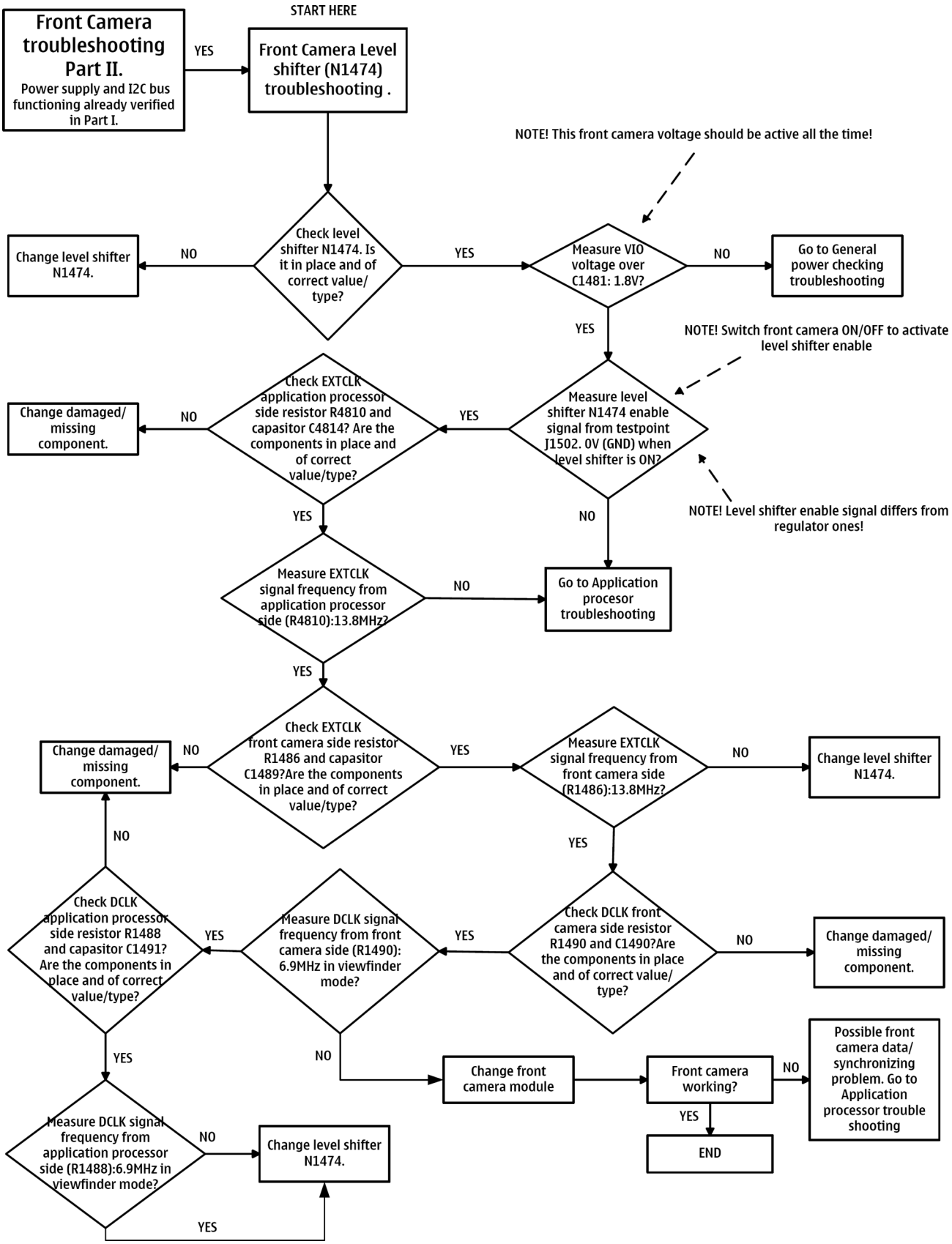

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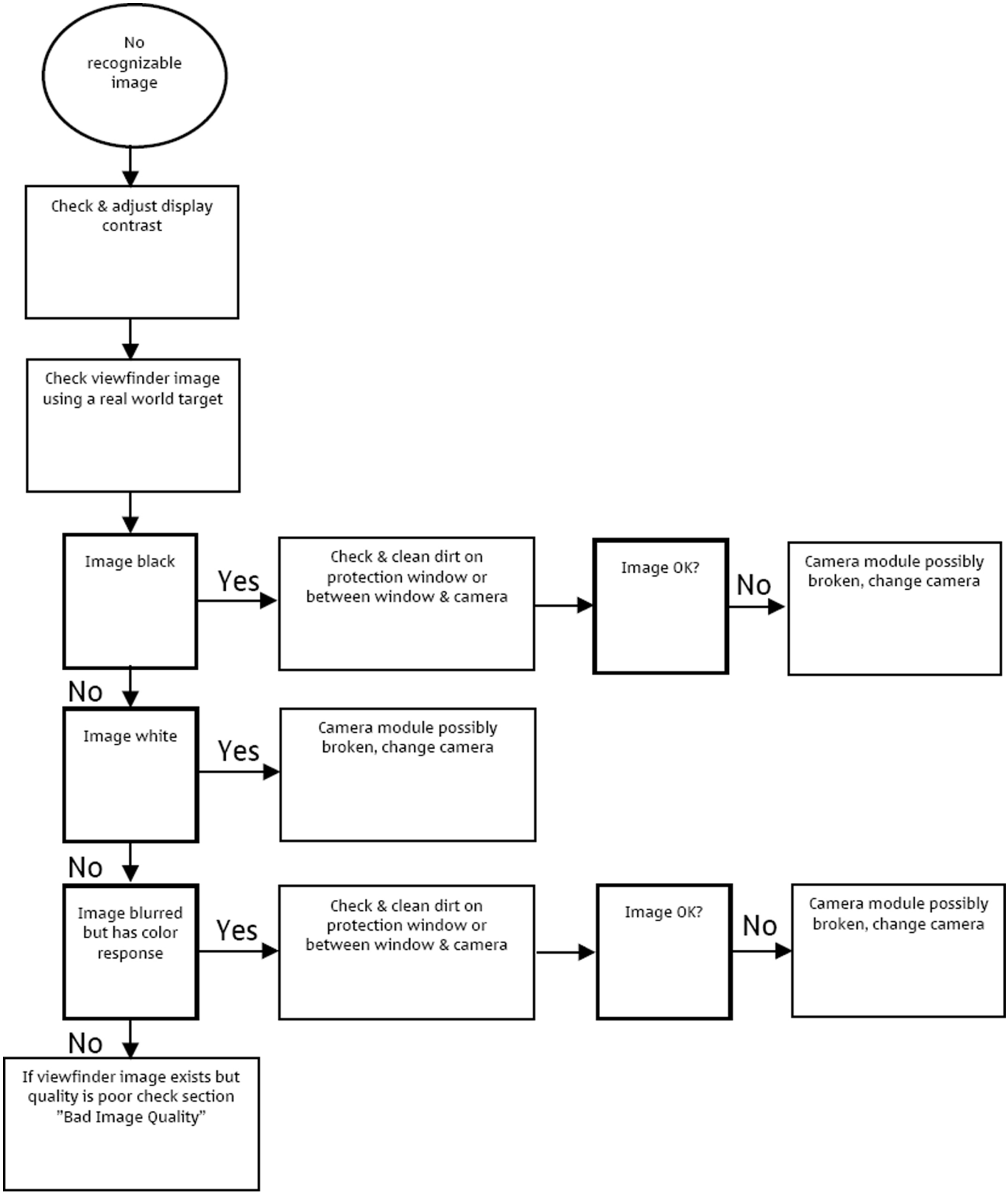
Front camera viewfinder troubleshooting

Troubleshooting flow



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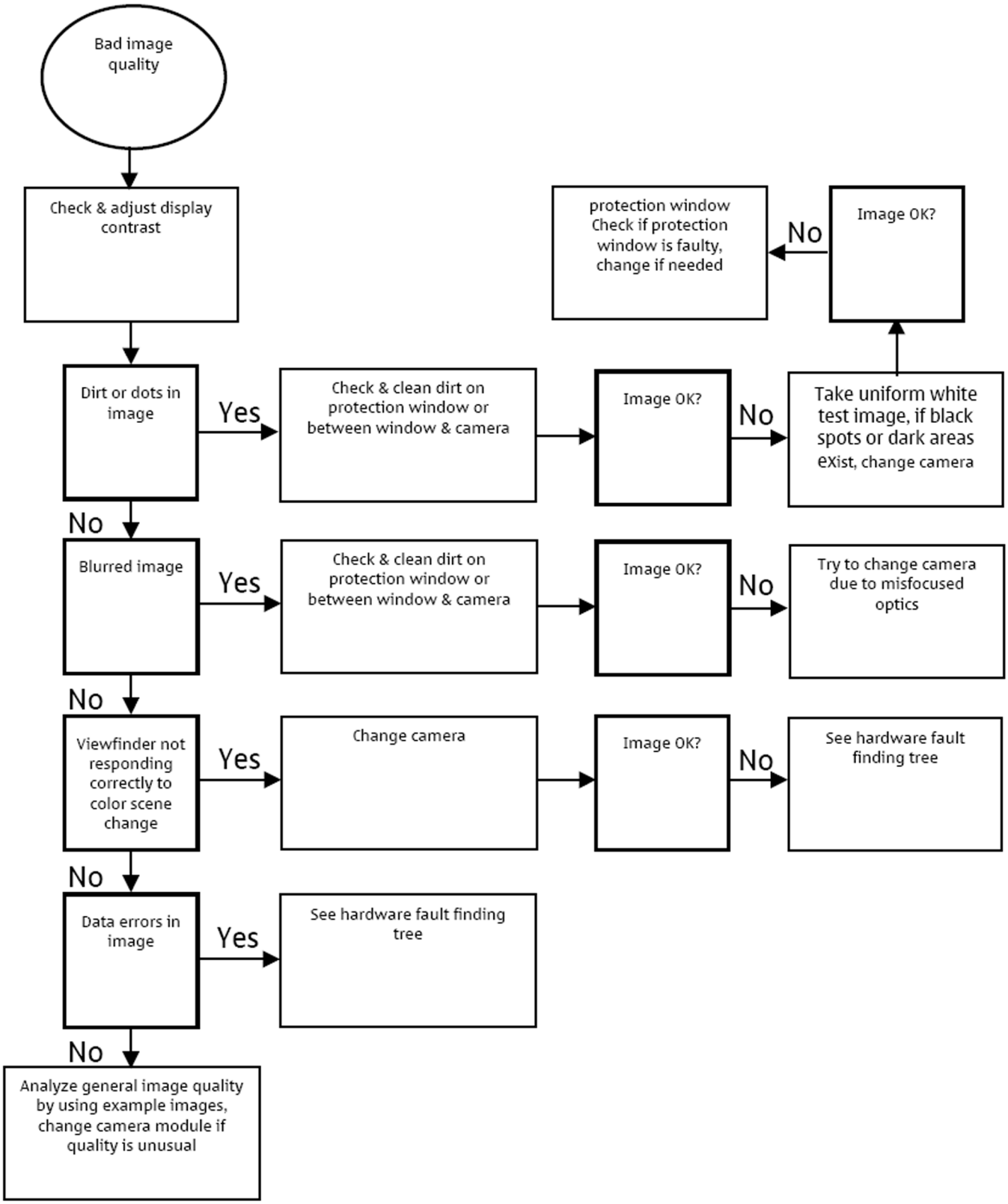
Front camera bad image quality troubleshooting

Troubleshooting flow



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Flash LED troubleshooting

Introduction to flash LED troubleshooting

A fault or complaint associated to LED flash operation can be roughly categorized into two subgroups:

1 Flash is not functional at all (no light output at all).

2 Images can be taken and they are recognizable but for some reason the quality of images is degraded.

The quality of an image is very difficult to measure quantitatively, and even comparative measurements are difficult (comparing two images), if the difference between reference images is small. If a user is not satisfied with his/her device's image quality, it is fairly difficult to accurately test the device and get an exact result, which would tell if the device is working properly.

Often subjective evaluation has to be used for finding out if there is something wrong in the flash. Some training or experience of a correctly operating reference device may be needed in order to detect possible faults. It is easy for a user to take low quality images in bad conditions. Therefore, the camera and flash operation has to be always checked in constant conditions (lighting, temperature) or by using a second, known-to-be good reference device.

Flash LED and image taking conditions

This section describes some of common factors, which may cause poor image quality if not taken into account by end users when taking pictures, and may therefore result in complaints. The items described are normal to the camera and LED flash operation and do not raise a need for servicing the components.

Figure 80 Example of a good quality image taken with the flash LED

Distance to the target (too close)

There is no feedback in the flash system, which means that the light output is constant in every situation. This causes the images to overexposure, when shot from close distance. The flash LED is designed to work optimally between distances of 70 cm – 1.2 m.

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This is normal behaviour; do not change the flash module.

Figure 81 overexposed image

Distance to the target (too far away):

The power of the white LED flash is still very modest compared to xenon flash technology. Even with full power, the maximum distance for an acceptable image quality is roughly 1.2 m. If the distance is greater than 1.2 m, the images will appear dark and the noise level increases.

This is normal behaviour; do not change the flash module.

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Figure 82 Dark and noisy image

Shaken (= blurred) images

The traditional xenon flash has the advantage of stopping the movement. This is a result of an extremely short and intense light pulse, which makes it possible for a camera to use very short exposure time. Due to the weak output of the LED flash, the exposure time has to be actually increased in the viewfinder mode in total blackness, instead of shortening it. This allows the sensor to integrate longer and collect more light but this also easily creates blurred images if care is not taken.

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Figure 83 Shaken image

Camera white balance failure and overexposure due to presence of ambient light

Because the spectral output of the flash is known, the white balance and the exposure control of the camera work in optimal way with the flash in total blackness. This is why some of the pictures may fail, if there is some ambient light present when the image is taken.

If the flash works correctly in dark conditions, there is no need to change the flash module.

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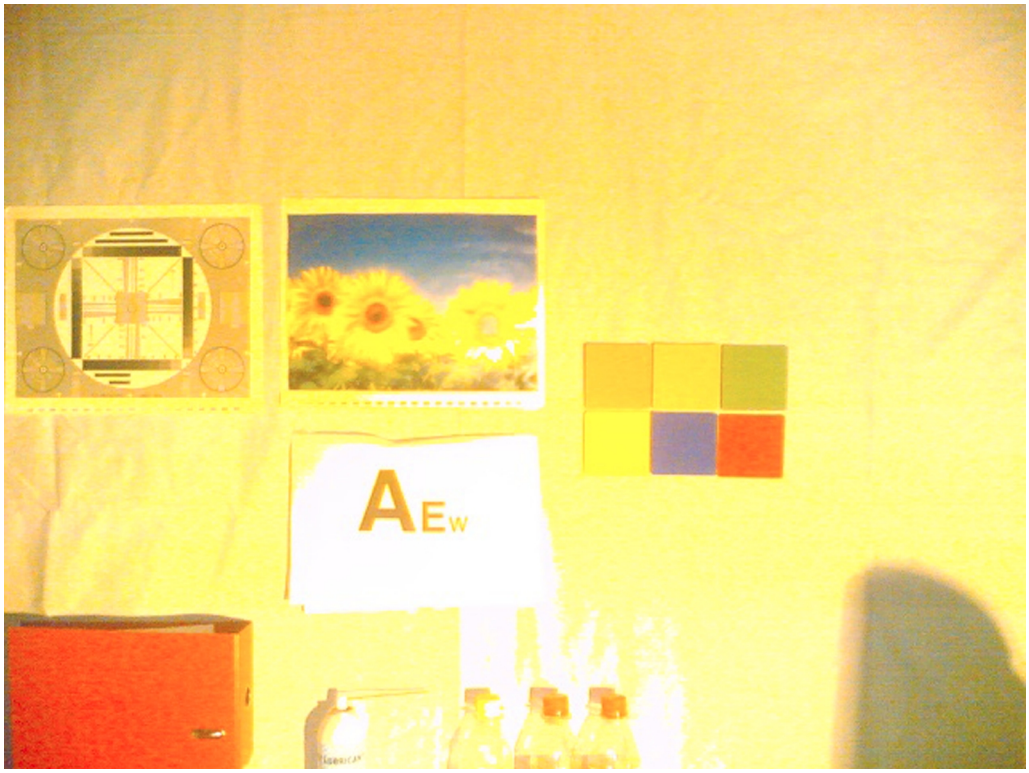

Figure 84 Camera white balance failure and overexposure

Colour difference between different modules

There is some variation in the spectrum of the flash, which derives from the manufacturing process of the white LEDs. Because of this variation, there may be some variation in the colour of the images as well.

This is normal behaviour; do not change the flash module.

Figure 85 Color difference between flash colour limit samples

Flash LED construction

This section describes the mechanical construction of the LED flash module.

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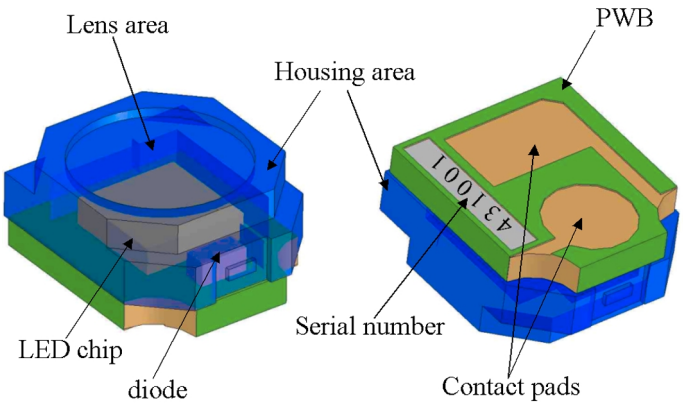

Figure 86 Mechanical construction of the flash LED module

The flash LED module as a component is not a repairable part, meaning that. components or parts in the module cannot be changed. Only cleaning dust from the lens is allowed using clean compressed air.

The main parts of the module are:

- Housing, which is glued to the PWB
- Lens area (round area on top of the housing with circle patterns)
- LED chip (yellow chip inside the housing), which is soldered to the PWB
- ESD protection diode (black passive component inside the housing), which is soldered to the PWB
- PWB
- Contact pads
- Laser marked serial number

The flash LED is fixed to the phone mechanics with special clips. The contacts to the main PWB are formed by using spring connectors.

Analysing image quality

Possible faults in image quality

When checking for possible errors in the flash functionality, knowing what error is suspected, significantly helps the testing by narrowing down the number of possible test cases. The following types of image quality problems may be expected to appear:

- LED module is not flashing at all
- Image colours are not good
- Flash power is weak

Testing flash module functionality

Context

With the help of this test you can check the flash module's overall functionality.

Always set the flash to FORCED FLASH mode when performing the test. The FORCED FLASH mode enforces the LED module to flash, even if there is some ambient light present.

Steps

1. Take an image with the flash and monitor at same time whether the LED module flashes.

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Results

If the LED flashes normally, the overall functionality of the module is OK.

Testing image colours with flash

Context

With the help of this test you can check if the image colours are normal when using the flash.

Steps

1. Take an image of a target, which contains something white in total blackness from less than 1 m range.

Results

If the white target appears to be white, the flash is working correctly. However, remember that there is some variation in the flash colour from module to module.

Testing flash power

Context

With the help of this test you can check if the flash is working with adequate power level.

Steps

1. Take an image with the flash in total blackness (ambient light <1 lux) of a target 80 cm - 1 m away.

Results

If the flash is working normally with adequate power level, the image is correctly exposed between distances 80 cm to 1 m.

Remember that the brightness level in the corners is always less than in the center of the image because of camera and flash optics.

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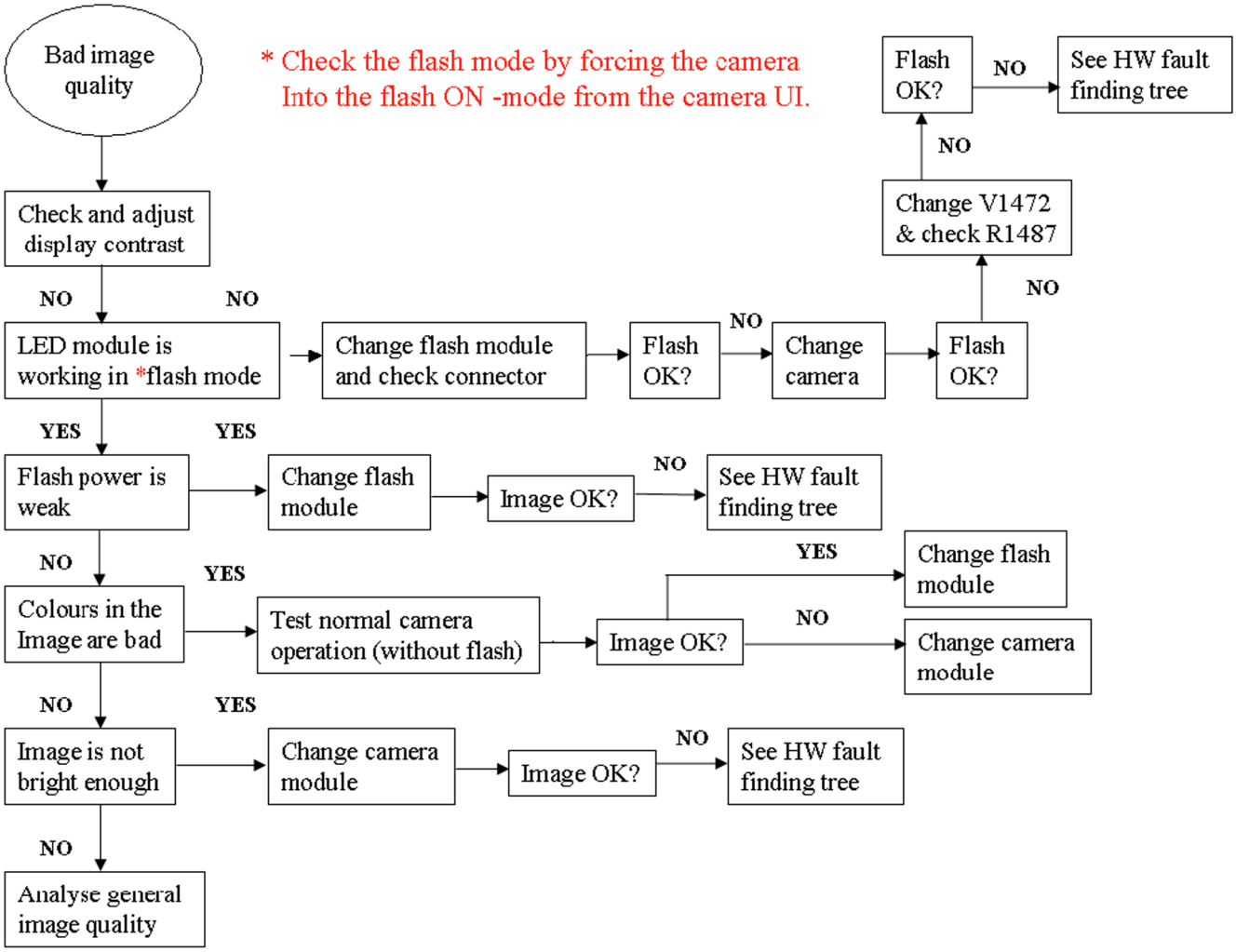
Flash LED troubleshooting flowcharts

Bad image quality when using flash LED

Troubleshooting flow



Flash LED indicator mode troubleshooting

For checking the indicator mode functionality, force the camera to record a video clip and monitor the flash led at the same time. The flash LED should work with very low brightness constantly during the video recording.

Flash LED HW baseband troubleshooting

Troubleshooting flow

If there are problems in the flash LED driver circuit, the testing procedure is complicated, because the driver circuit output cannot be reliably measured without the load (LED). Load (LED) is always disconnected from the output when the phone is disassembled.

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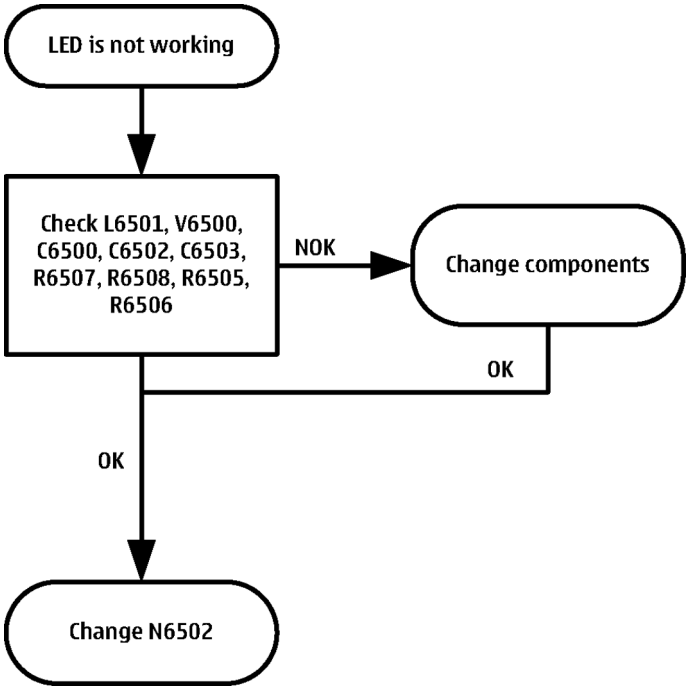

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9 — System Module

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Baseband description

System module block diagram

The device consists of two different main modules: transceiver and UI. The transceiver board consists of baseband and RF components. The UI board consists of key domes and keypad backlights. Connection between the UI and the transceiver board is established via a board-to-board spring connector.

Note: In this description, the user interface HW covers display, camera, keyboard, keyboard backlight and ALS.

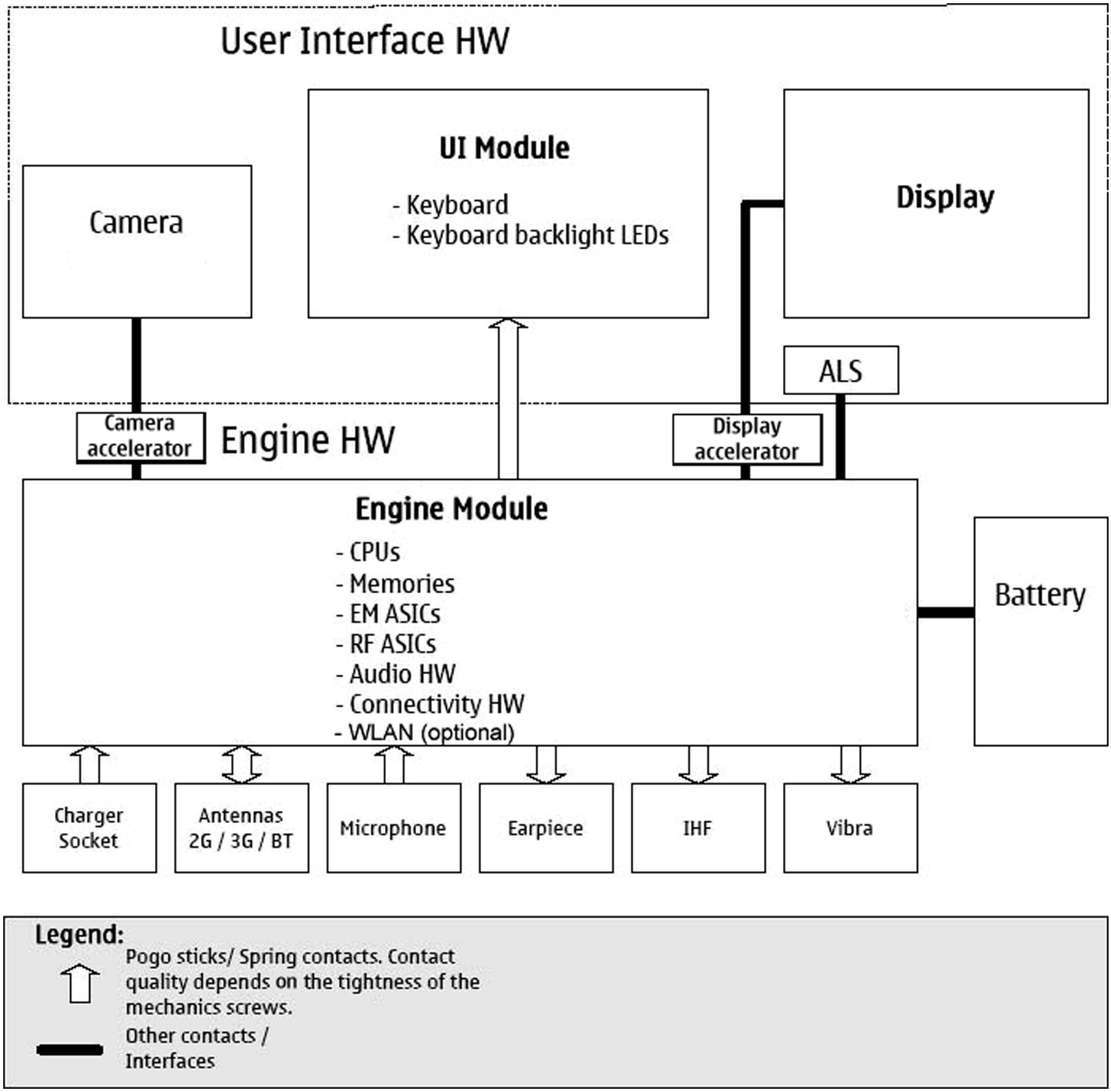

Figure 87 System level block diagram

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Baseband functional description

Digital baseband consists of an ISA (Intelligent Software Architecture) based modem and Symbian based application sections. The modem functionality is in RAP, and the application processor acts as a platform for Symbian applications. The terms ISA and Symbian are used refer to the software environment of these devices.

The modem section consists of a RAP ASIC with NOR FLASH and SDRAM memory as the core. RAP supports WCDMA and GSM cellular protocols. The modem DDR SDRAM memory has 128 Mbits of memory and NOR flash has 128 Mbits of memory. RAP operates with the system clock of 38.4 MHz, which comes from the VCTCXO.

The application section includes an application processor ASIC with DDR/NAND combo memory as the core.

Absolute maximum ratings

Signal	Min	Nom	Max	Unit	Notes
Battery voltage (idle)	-0.3		+4.5	V	Battery voltage maximum value is specified during charging is active
Battery voltage (Call)	+3.2		+4.3	V	Battery voltage maximum value is specified during charging is active
Charger input voltage	-0.3		+20	V	
Back-Up supply voltage	0	2.5	2.6	V	Maximum capacity of the backup power supply assumed to be 3 µAh.

Phone modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below EM ASIC N2200 master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over EM ASIC N2200 master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. In this mode certain regulators are enabled and after they and RFClk have stabilized, the system reset (PurX) is released and PWR_ON mode entered. RESET mode uses 32kHz clock to count the REST mode delay (typically 16ms).

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Mode	Description
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low. There are in principle three different sleep modes: • application processor sleep • RAP sleep • application processor and RAP sleep (deep sleep) In SLEEP mode N2200's regulators VIO, VDRAM, VSIM1, and Vana are in low quiescent current mode (output voltages still present but regulators will not give as much current out). VSIM2 is permanently off, and VAUX is always in the power on mode. Other regulators including VR1 supplying system clock oscillator are disabled. In SLEEP mode, EM ASIC N2300 VCORE SMPS regulator is in low quiescent current mode (if sleep mode is not internally disabled). Linear regulator VOUT state depends on the accessory connected to the system connector, if there is any.
FLASHING	FLASHING mode is for SW downloading.

Voltage limits

Parameter	Description	Value
VMSTR	Master reset threshold (N2200)	2.2V (typ.)
VMSTR+	Threshold for charging, rising (N2300)	2.1V (typ.)
VMSTR-	Threshold for charging, falling (N2300)	1.9V (typ.)
VCOFF+	Hardware cutoff (rising)	2.9V (typ.)
VCOFF-	Hardware cutoff (falling)	2.6V (typ.)
SWCOFF	SW cutoff limit	~3.2V

The master reset threshold controls the internal reset of EM ASICs. If battery voltage is above VMSTR, N2300 charging control logic is alive. Also, RTC is active and supplied from the main battery. Above VMSTR, N2300 allows the system to be powered on although this may not succeed due to voltage drops during start up. SW can also consider battery voltage too low for operation and power down the system.

Power key

The system boots up when power key is pressed (adequate battery voltage, VBAT, present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). Power on key is connected to the EM ASIC N2200 via PWRONX signal.

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Power distribution

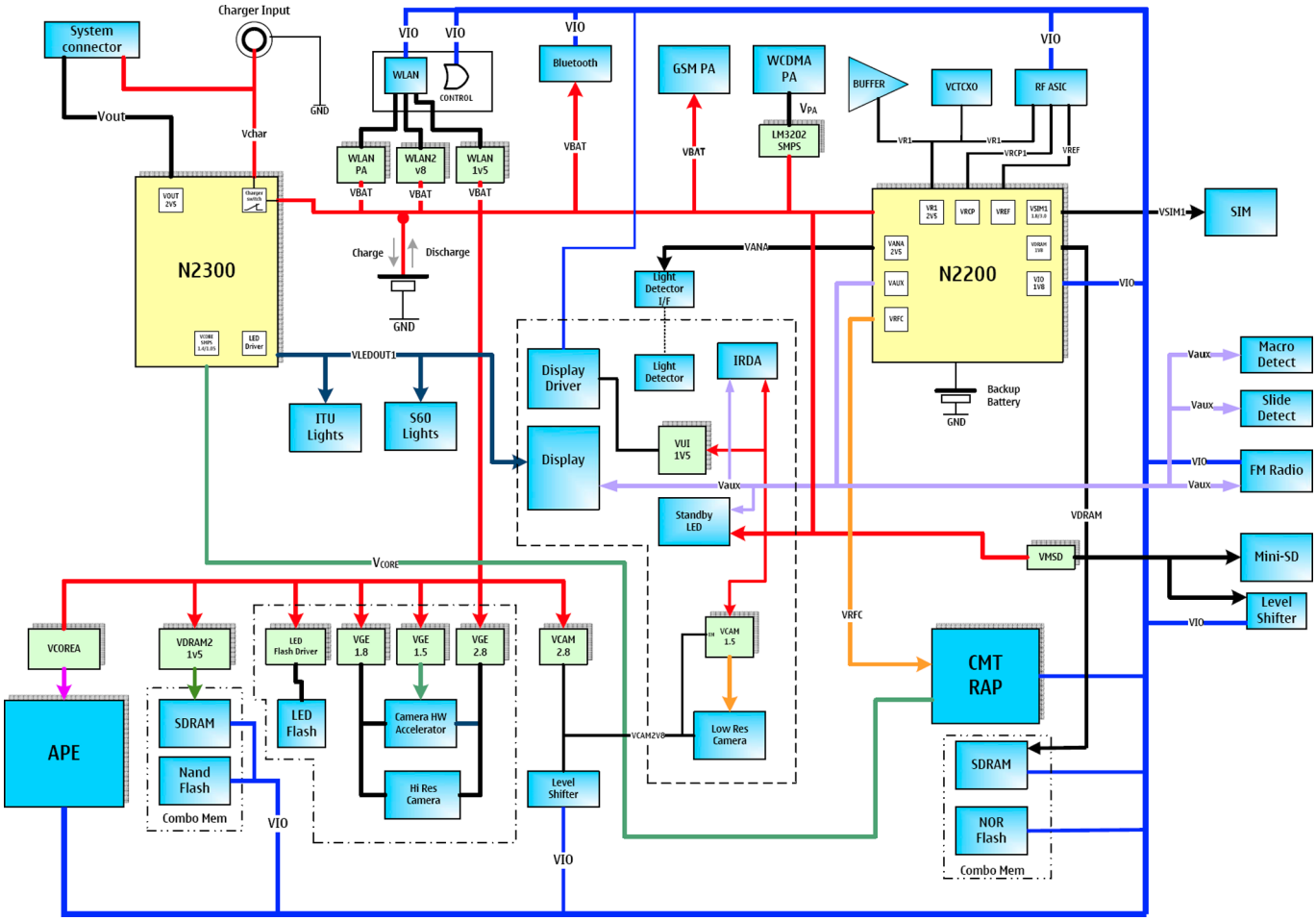

Figure 88 Power distribution diagram

Power supply components:

- EM ASIC N2200
- EM ASIC N2300
- Application processor VCORE SMPS, N4200
- WLAN module supplies: N5501, N5502 and N5503
- APE ADRAM LDO: N4201
- Camera and camera accelerator supplies: N6504, N6501 and N6500
- Mini SD regulator: N3500
- Flash LED driver: N6502
- Front camera regulator: N4405

On the UI PWB:

- Second front camera regulator N5
- Display accelerator regulator N2

All the above are powered by the main battery voltage.

Battery voltage is also used on the RF side for power amplifiers (GSM PA & WCDMA PA) and for RF ASICs.

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Discrete power supplies are used to generate 2.8 V to BT, 1.5 V for the camera IO voltage, 2.8 V for the front camera IO voltage, 1.3 V/1.5 V for the application processor and 18 V for the backlight LEDs. The device supports both 1.8 V/3 V SIM cards which are powered by VSIM1. VSIM2 is used to enable the regulator used to supply 3V for the mini-SD card interface.

USB accessories which need power from the device are powered by N2300 / VOUT.

The internal LED driver in N2300 is used in this engine implementation.

System power-up

After inserting the main battery, regulators started by HW are enabled. SW checks, if there is some reason to keep the power on. If not, the system is set to power off state by watchdog. Power up can be caused by the following reasons:

- Power key is pressed
- Charger is connected
- RTC alarm occurs
- MBUS wake-up

After that:

- N2200 activates sleep clock and VANA, VDRAM, VIO and VR1 regulators.
- Voltage appearing at N2200 RSTX pin is used for enabling N2300 ASIC.
- N2300 enables VCORE regulator and its internal RC-oscillator (600 kHz).
- VCTCXO regulator is set ON and RF clock (main system clock) is started to produce.
- N2200 will release PURX ~ 16ms after power up is enabled (the RF clock is then stable enough).
- Synchronizing clock (2.4MHz) for N2300 is started to be produced. After PURX is released and two rising edges of 2.4 MHz synchronous clock have been detected in SMPSClk input N2300 is starting to use that instead of 600kHz internal RC-oscillator.
- HW start-up procedure has been finalized and the system is up and running. Now it is possible for SW to switch ON other needed regulators.

Clocking scheme

There are two main clocks in the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768 kHz sleep clock produced by the EM ASIC N2200 with an external crystal.

RF clock is generated only when VCTCXO is powered on by the EM ASIC regulator. Regulator itself is activated by SleepX signals from both RAP and application processor. When both CPUs are on sleep, RF clock is stopped.

RF clock is used by RAP, which provides (divided) 19.2MHz SysClk further to the application processor. Both RAP and the application processor have internal PLLs which then create clock signals for other peripheral devices/interfaces like RS MMC, SIM, CCP, I2C and memories.

32k Sleep Clock is always powered on after startup. Sleep clock is used by RAP and the application processor for low-power operation.

SMPS Clk is 2.4MHz clock line from RAP to EM ASIC N2300 used for switch mode regulator synchronizing in active mode. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4MHz signal from the RF ASIC to the Bluetooth system.

CLK600 is 600KHz signal from EM ASIC N2300 to APE VCORE SMPS. The clock source is internal RC oscillator in EM ASIC (during the power-up sequence) or RAP SMPS Clk divided by 4 after the power-up sequence.

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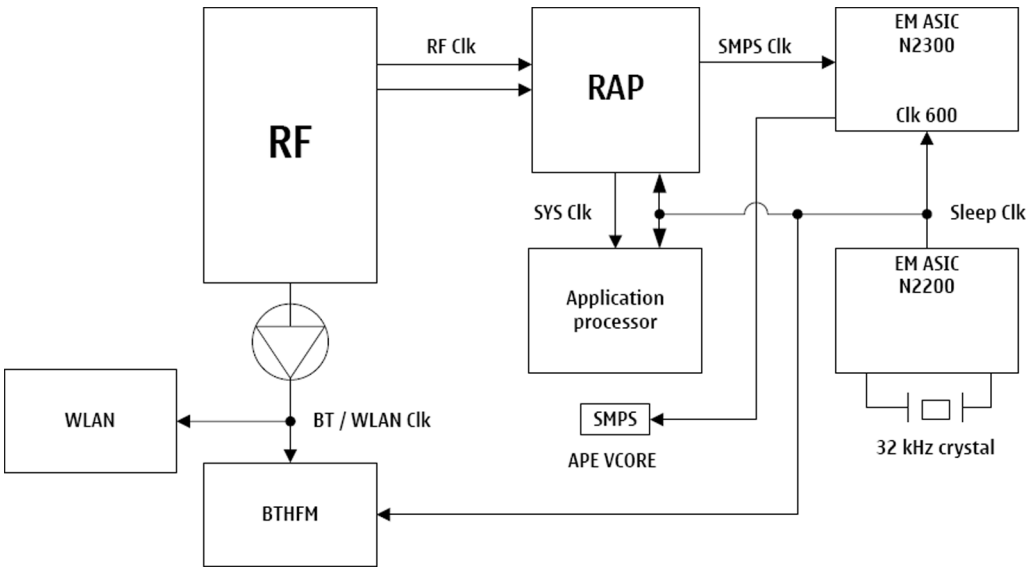

Figure 89 Clocking scheme

Bluetooth

The Bluetooth and WLAN solutions share a common antenna. The BT antenna path passes through the WLAN module, and whilst BT and WLAN are both active, the use of the antenna is negotiated via the BT-WLAN interacitivity lines WLANBT_CSX(3:0).

When WLAN ins inactive, the BT acquires the antenna by the action of the BT_CLOCK_REQUEST line, which enables the WLAN power regulators N5501, N5502 and N5503 via OR gate D5500. These regulators power up part of the WLAN module, thus enabling only its internal RF switch for BT use, whilst the remainder of the WLAn functionality remains sleeping.

Bluetooth provides a fully digital link for communication between a master unit and one or more slave units. The system provides a radio link that offers a high degree of flexibility to support various applications and product scenarios. Data and control interface for a low power RF module is provided. Data rate is regulated between the master and the slave.

FM radio

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as poles of the antenna, and no other antenna is needed for FM radio reception.

The antenna for the FM radio is provided by plugging in an external wired headset to the system connector. It is not possible to listen to the FM radio without a wired headset connected. The FM radio is controlled by I2C commands from RAP. The audio output of the FM radio is fed to the headset via EM ASIC N2200, so the rest of the phone can sleep while the FM radio is active.

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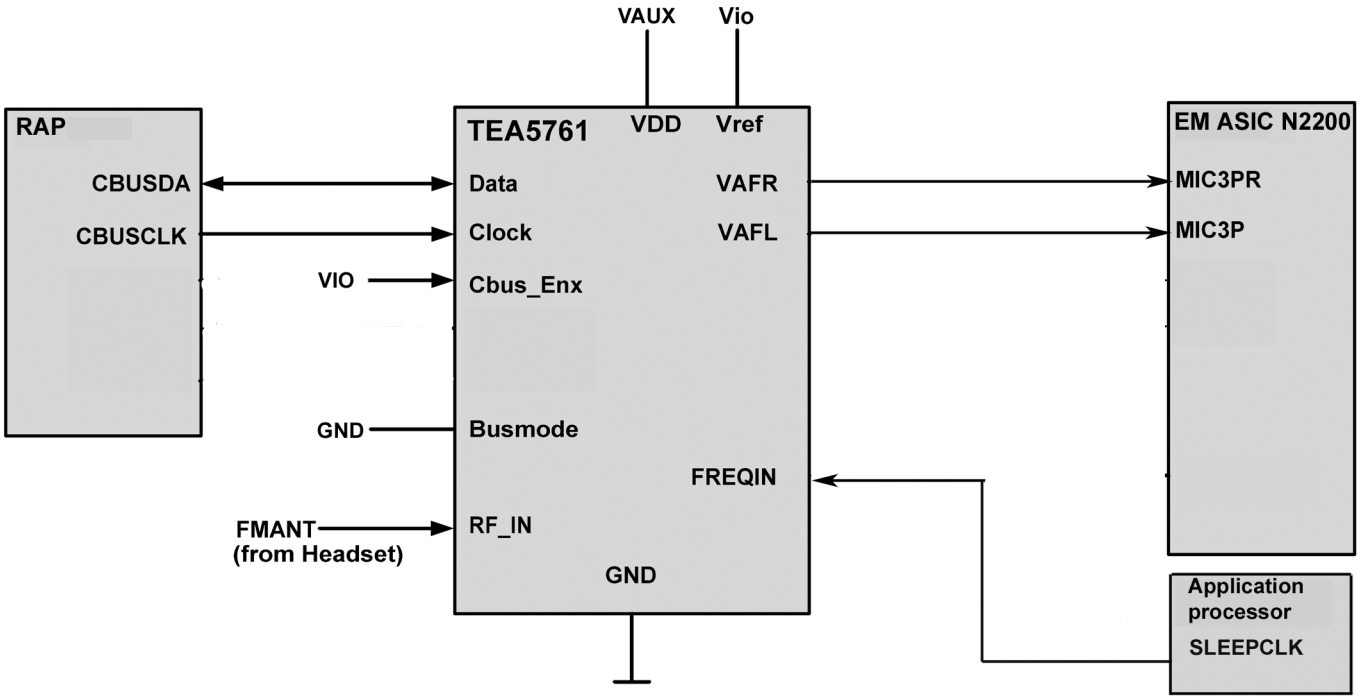

Figure 90 FM radio module interface to engine

USB

USB (Universal Serial Bus) provides a wired connectivity between a USB host PC and peripheral devices.

USB is a differential serial bus for USB devices. USB controller (RAP) supports USB specification revision 2.0 with full speed USB (12 Mbps). The device is connected to the USB host through the system connector. The USB bus is hot plugged capable, which means that USB devices may be plugged in/out at any time.

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAP and EM ASIC N2200 and of an external interface between N2200 and SIM contacts. The main SIM interface functionality is in RAP while N2200 takes care of power up/down, card detection, ATR (Answer To Reset) counting and level shifting. For N2200 external SIM IF connections, see section SIM interface connections.

The SIM IF is shown in the following figure:

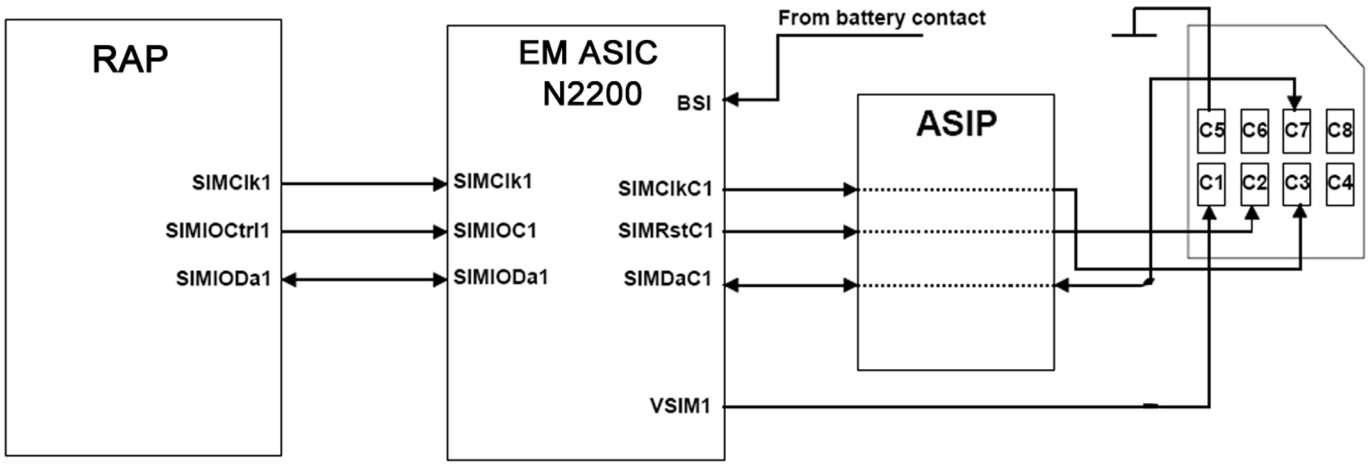

Figure 91 SIM interface

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IrDA interface

IrDA specifies a low-cost, reliable, fully digital peer-to-peer data link between IrDA units at data rates from 9600 bits/s to 4Mbits/s. The link is based on the serial transmission of data as pulses of infra red light at the wave length of 870nm and angles of +-15degrees at the range 0 - 50 to 100 cm. Because of these restrictions and the optical nature of the link, the transmission is not omnidirectional but focused and only reaches a peer at a limited line-of-sight distance from the transmitter thus not disturbing any other units in the neighborhood.

SD card interface

The SD card is supplied with 3V supply voltage. The detection of the SD card removal/insertion is done by a switch in the card connector. Removing the SD card while writing to the card may corrupt data in the SD card. The switch is directly connected to host and it gives an interrupt to the SW while the status of the switch is changed. SW turns power off on the SD card by switching off the SD card and level-shifter power supply (VSD). When the SD card connector switch status changes the card should be identified if card exists.

WLAN interface

A Wireless Local Area Network (WLAN) is a flexible data communication system in which a mobile user can connect to a local area network through a wireless connection. A standard, which specifies the technologies for WLAN, is called IEEE 802.11.

Battery interface

The battery interface supports a 3-pole battery interface. The interface consists of three connectors: VBAT, BSI and GND.

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

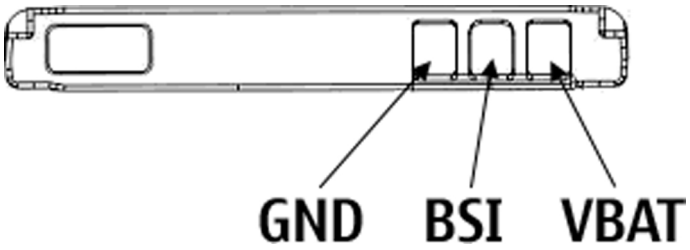

Figure 92 Battery pin order

Battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line, which is located on the transceiver PWB, at a place where the phone temperature is most stable.

For service purposes, the device SW can be forced into local mode by using pull down resistors connected to the BSI line.

Camera interfaces

Back camera interface

The back camera of the device uses a SMIA95 3.0 mega pixel module with macro mode producing pictures with a resolution of up to 2048x1536.

The camera regulator N1470 powers the digital parts of the camera, and a VAUX power rail is used for powering the analogue parts.

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Camera construction

This section describes the mechanical construction of the camera module for getting a better understanding of the actual mechanical structure of the module.

Table 14 Camera specifications

Sensor type	CMOS
Sensor photo detectors	3 million
F number/Aperture	f/3.5
Focal length	4.7 mm
Focus range	Macro Mode: 17.5 to 23.4 cm Normal mode: 68 cm to infinity
Still Image resolutions	2048x1536, 1600x1200, 1280x960, 800x600, 640x480
Still images file format	EXIF (JPEG), *.jpg
Video resolutions	352x288, 176x144, 128x96 all 15 frames per second
Video clip length	30 seconds or free, maximal clip length in free mode is 1 hour
Video file format	3GPP, *.3gp or MPEG-4, *.mp4 (64 kbps in short mode and 128 kbps in maximum mode)
Exposure	Automatic
White Balance	Automatic or adjustable
Colours	16.7 million / 24-bit

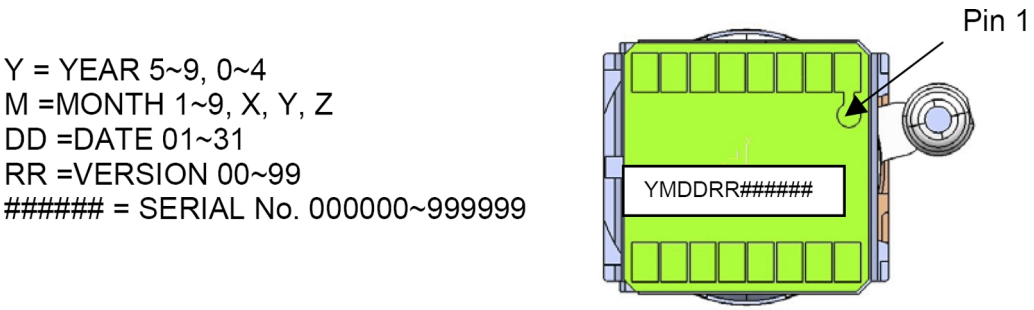

Figure 93 Camera module bottom view including serial numbering

The camera includes a macro function that adjusts the focus distance for near-by objects – the position of this function is detected by a hall-effect sensor on the engine PWB (N4401) and a magnet that is attached to the macro ring in the camera module

Flash LED

The device back camera has a flash LED (FLED) located directly beside the camera, providing better lighting conditions in darker environments. The same LED is also used as an indicator light to indicate video clip recording, and to indicate when pictures are being taken as a privacy indicator.

The operating range of the FLED is approximately 1 m (~22 Lux) and 1.5 m (~9 Lux). The connections between the main PWB and the FLED are implemented with a pair of “pogo” pins shown as X6501 on the schematic.

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The FLED has four white LEDs connected in series in one module. The module also includes a lens with its plastic housing to ensure a proper light pattern at the target.

The dimensions of the FLED are 6.5 x 7.5 x 3.5 mm.

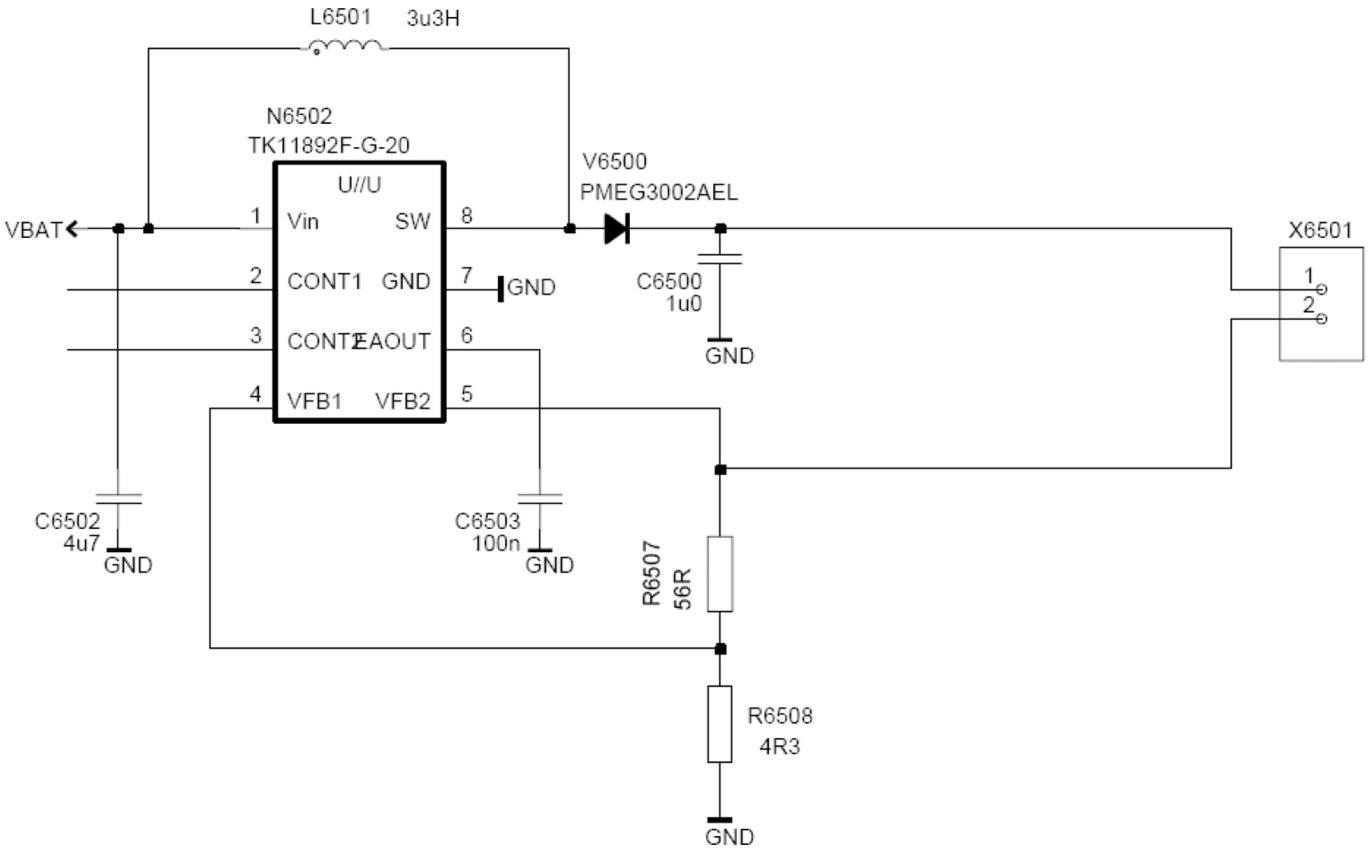

Figure 94 Simplified flash LED connection

Front camera

The front camera has VGA (640x480) resolution, and it is mainly used for video calls. It can also be used as a still camera and camcorder.

The front camera is controlled and its data is collected by the application processor.

The front camera has the following characteristics:

Sensor type:	CMOS
Sensor Photo detectors:	VGA
F number/Aperture:	f/2.9
Focal length:	4.5 mm
Focus range:	40 cm to infinity
Still Image resolutions:	640 x 480
Video resolutions:	176 x 144, 128 x 96 both 15 frames per second.
Video clip length:	30 seconds or free, maximal clip length in free mode is 1 hour
Video file format:	MPEG-4 *.mp4 and 3GPP, *.3gp (64 kbps in short clip mode, 128 kbps in maximum mode)

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Exposure:	Automatic and manual
White Balance:	Automatic or adjustable
ISO:	250 - 1000 (Automatic)
Capture Modes:	Still capture mode, video mode, sequence mode 10,20 or 30 seconds.

User interface

The user interface of the handset is mostly contained in the top half of the product, connected to the main section through the slide mechanism by a flexi circuit.

The UI board consists of a 4-layer PWB containing:

- IrDA interface device
- low-power flashing LED circuit
- front facing camera
- display accelerator ASIC
- interconnections for the display
- interconnections for the S60 UI PWB

The user interface sections contained on the engine PWB are:

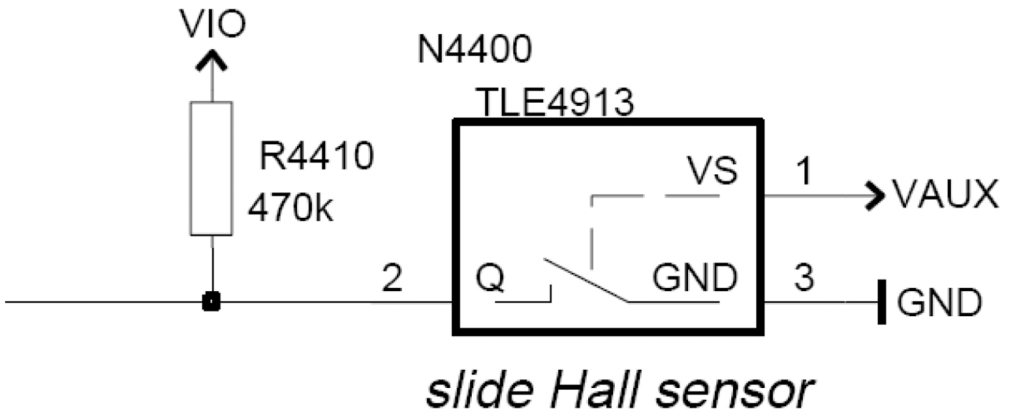
- main power key
- ITU keymat
- dedicated camera shutter key

Main flexi

The two halves of the device are connected by a flexi with 70 way connectors at each end that allows for the required signals to pass from the engine to the UI board. No service is possible for the flexi, if it is damaged or faulty it should be replaced.

Slide position sensor

The position (open/shut) of the slide is detected by means of a Hall-effect sensor on the engine PWB (N4400) and a magnet positioned in the UI slide assembly. The magnet is positioned so that the sensor detects the fully open position of the slide.



slide Hall sensor

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Keyboards

The device keyboard is split between the main ITU 3x4 keyboard located on the engine board and the remainder of the keyboard located on the S60 UI board on the other side of the slide module. All the keys are located as part of the same matrix, and are connected directly to the APE ASIC in the case of the keys on the engine PWB, and through ASIPs in the case of the keys on the S60 PWB.

Key matrix assignments:

Key	Row	Column	Switch reference
0	6	0	S4413
1	3	2	S4407
2	2	1	S4404
3	2	2	S4403
4	5	3	S4412
5	3	0	S4408
6	3	3	S4406
7	2	0	S4405
8	2	3	S4414
9	4	0	S4411
*	4	1	S4410
#	4	3	S4409
END	5	0	U13
SEND	1	1	U4
CLEAR	6	2	U2
APPS	6	3	U12
EDIT	6	1	U3
Operator/Media	5	2	U1
NAVI left	0	2	S1
NAVI right	0	3	S1
NAVI up	1	2	S1
NAVI down	1	3	S1
NAVI select	1	0	S1
Left Soft Key	0	0	U10
Right Soft Key	0	1	U8
Camera	4	2	S4402

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Keyboard layouts

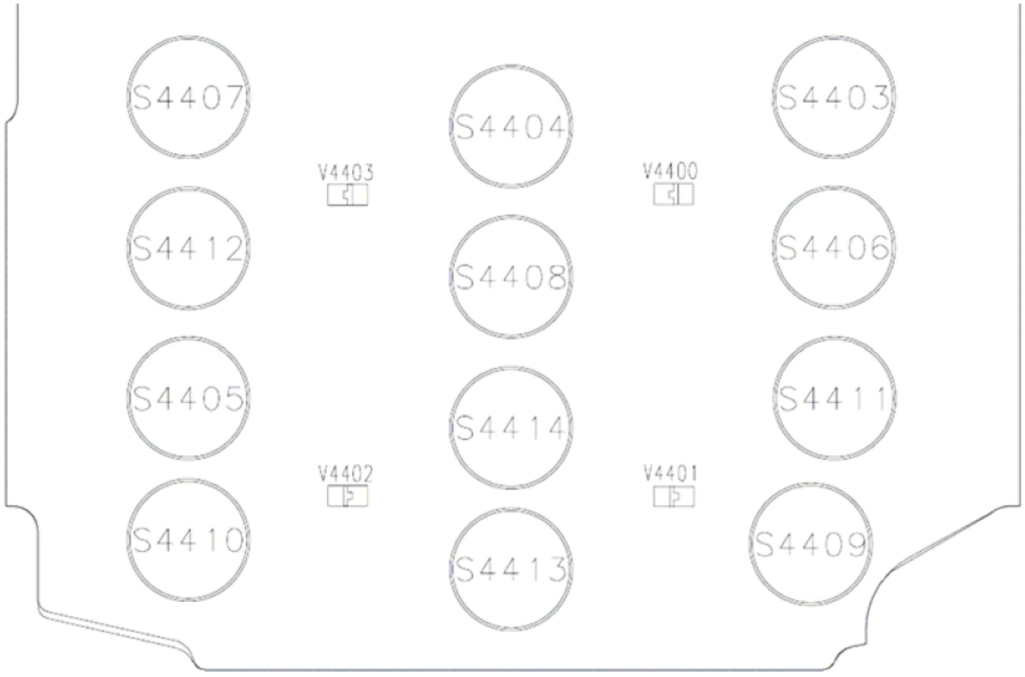

Figure 95 Engine PWB keyboard layout

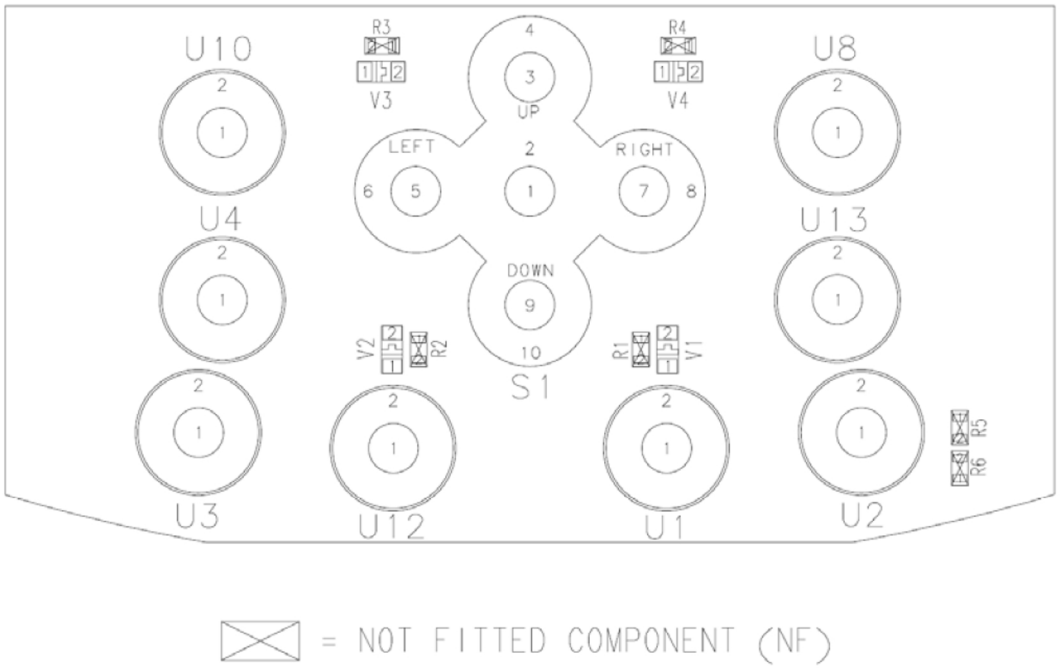

Figure 96 S60 PWB keyboard layout

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Display interface

Display module mechanical concept

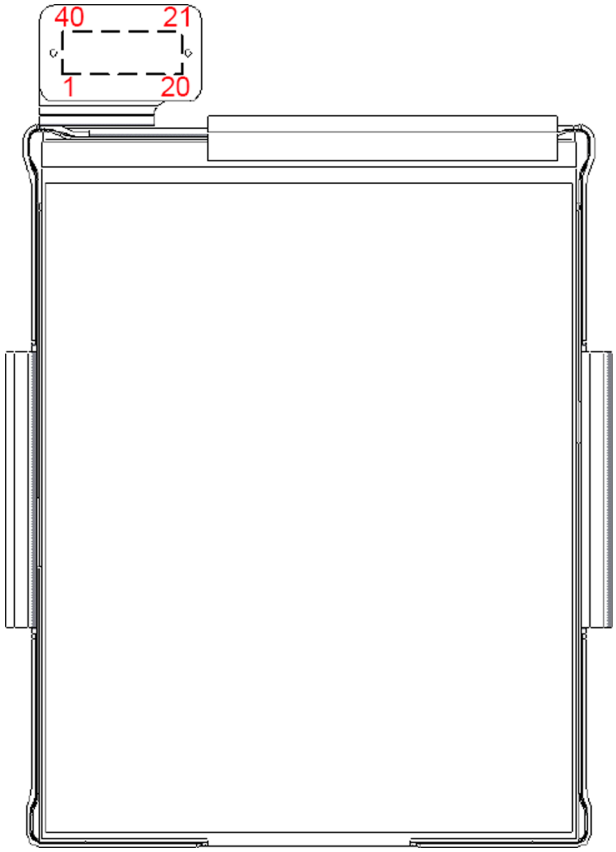

Figure 97 General diagram of the LCD module

Display features:

- 262,144 colours (18-bit mode)
- partial display function power saving by pausing display process on part of the screen
- no full-image built in RAM, so display accelerator is needed

The display has two different operating modes:

1 normal mode, full screen, 260k colours

2 normal partial mode, 8 colours but only part of the display is active

The interconnection between the LCD module and the UI PWB is implemented with a 40-pin board-to-board connector.

The display module does not require any tunings in service.

Display and keyboard backlight

The device uses the internal LED driver in N2300 to drive the LEDs in both the keyboards and the display. Each chain of LEDs consists of 4 LEDs, resulting in 12 LEDs in total.

Current feedback is done through the display LEDs only, with the two keyboard chains being driven from the display LED voltage through two emitter followers:

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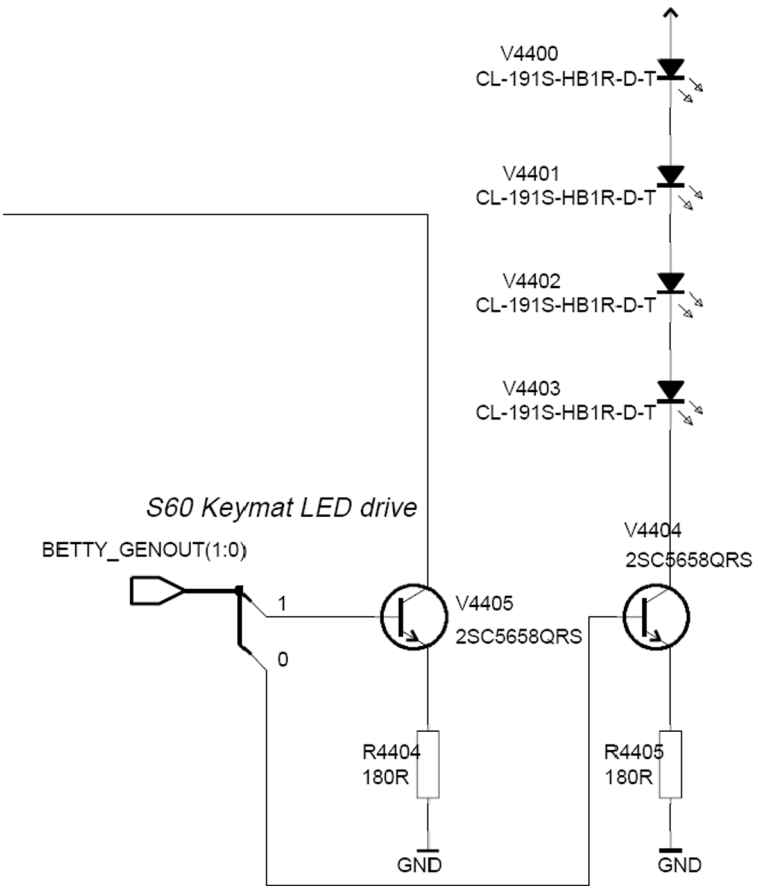

Table 15 LED driver control signals

	From	To	Voltage	Function
GenOut 1	N2300	V4405	0V/1.8V	S60 LED control
Genout 0	N2300	V4404	0V/1.8V	ITU LED control

Typically, keyboard LEDs are turned ON only in dark ambient light conditions. The ITU keymat LEDs are extinguished when the device detects that the slide has been closed.

ALS interface

Ambient Light Sensor (ALS) is located in the upper part of the phone. It consists of the following components:

- lightguide (part of the front cover)
- phototransistor (V4400) + resistor (R4401)
- NTC + resistors (R4400, R4402, R4403)
- EM ASIC (N2200)

Information on ambient lighting is used to control the backlights of the phone:

- Keypad lighting is switched on only when the environment is dark / dim
- Display backlights are dimmed, when the environment is dark / dim

The ambient light sensor itself is a photo transistor, which is temperature-compensated by an external NTC resistor. N2200 reads the light sensor (LS) and temperature (LST) results.

ALS calibration is not possible in the service points. ALS is serviced by replacing faulty phototransistors.

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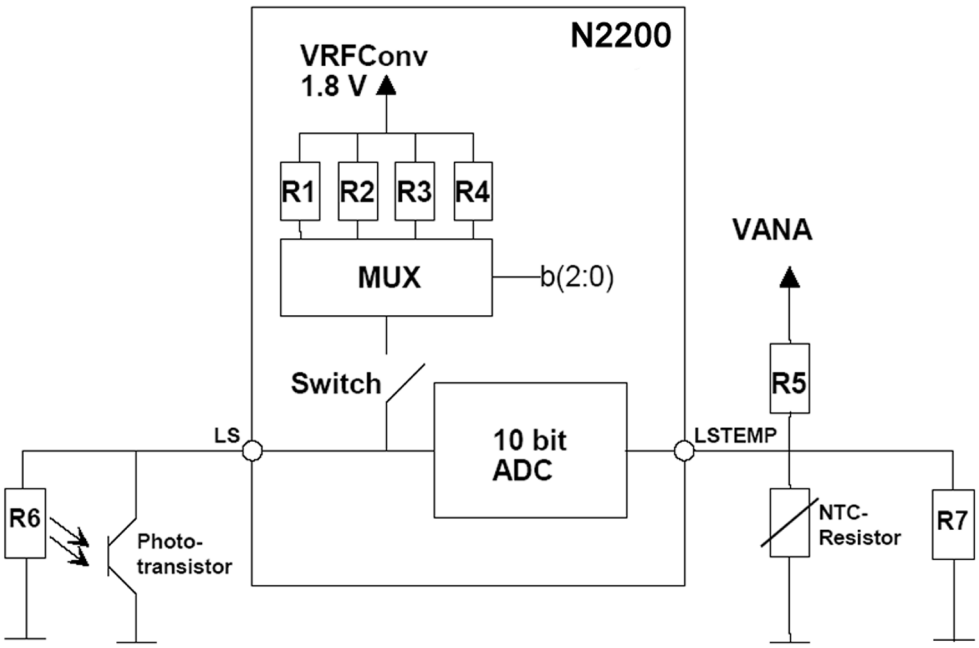

Figure 98 ALS HW implementation

Table 16 ALS resistor values

Symbol	R1	R2	R3	R4	R5	R6	R7	NTC-res
Value	5 kOhm	15 kOhm	30 kOhm	50 kOhm	470 kOhm	100 kohm	470 kohm	47 kOhm

ASICs

RAP ASIC

RAP ASIC is a 3G Radio Application Processor. RAM memory is integrated into RAP.

EM ASIC N2200

The EM ASIC (N2200) includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

EM ASIC N2300

The EM ASIC (N2300) includes the following functional blocks:

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- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- LED driver for backlights
- Digital interface (CBUS)

Device memories

RAP memories NOR flash and SDRAM

Modem memory consists of 128 Mbit SDRAM and 128 Mbit NOR flash memories.

Combo memory

The application memory of the device consists of NAND/DDR combo memory. The stacked DDR/NAND application memory has 512 Mbit of DDR memory and 1024 Mbit of flash memory. The DDR DRAM memory is stacked above the NAND flash.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around two ASICs: RAP CMT engine ASIC and the mixed-signal EM ASIC N2200.

There are three audio transducers:

- 7mm x 11mm dynamic earpiece
- 16mm dynamic speaker
- electret microphone module

In addition to the audio transducers, N2200 also provides an output for the dynamic vibra component.

All galvanic audio accessories are connected to the system connector accessory connector.

A Bluetooth audio module that is connected to RAP supports Bluetooth audio functionality.

There is a separate application processor for Symbian applications.

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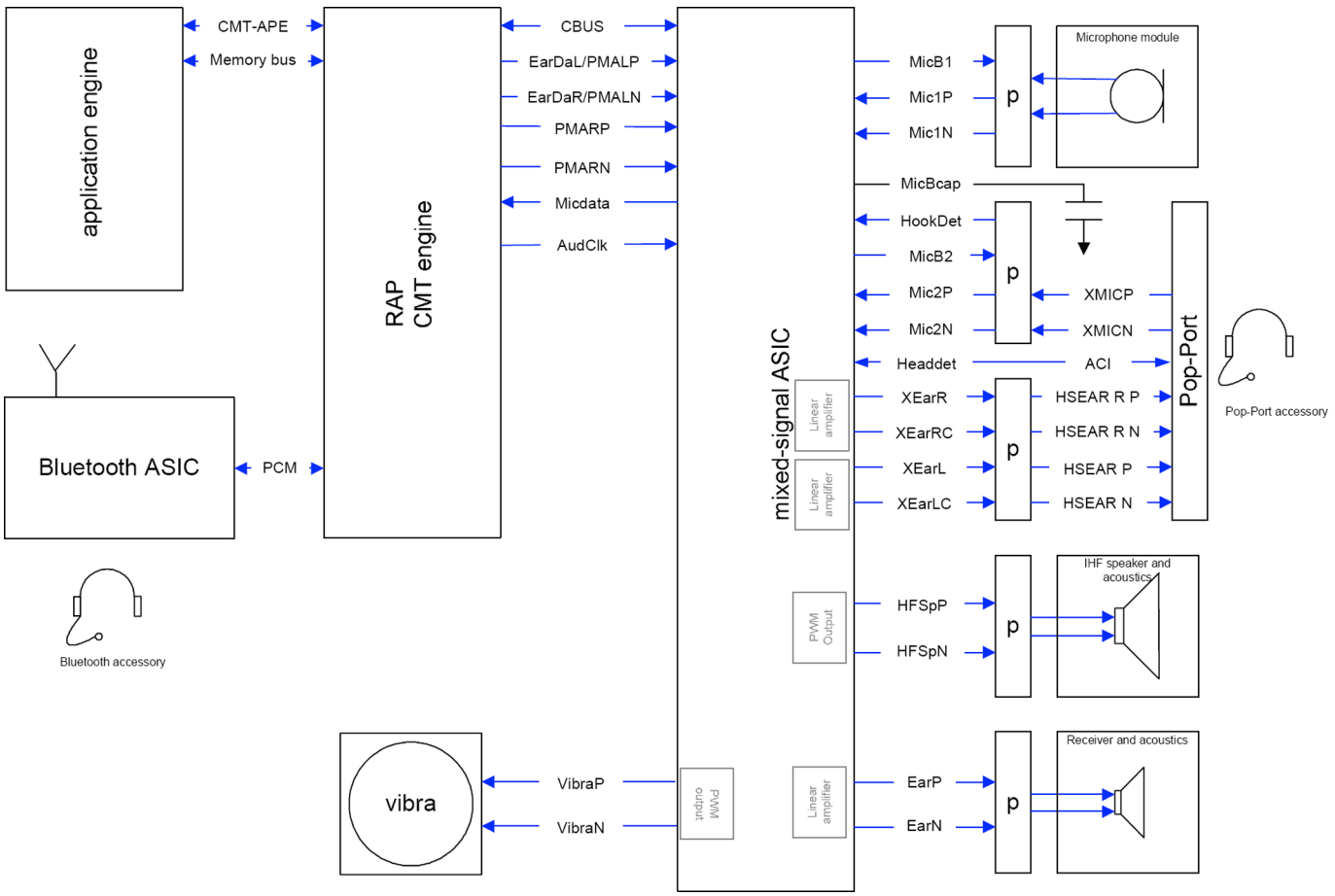

Figure 99 Audio block diagram

Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

An analogue electret microphone is connected to the EM ASIC (N2200) Mic1P and Mic1N inputs via asymmetric electrical connection.

The microphone is biased by the EM ASIC MicB1 bias voltage output.

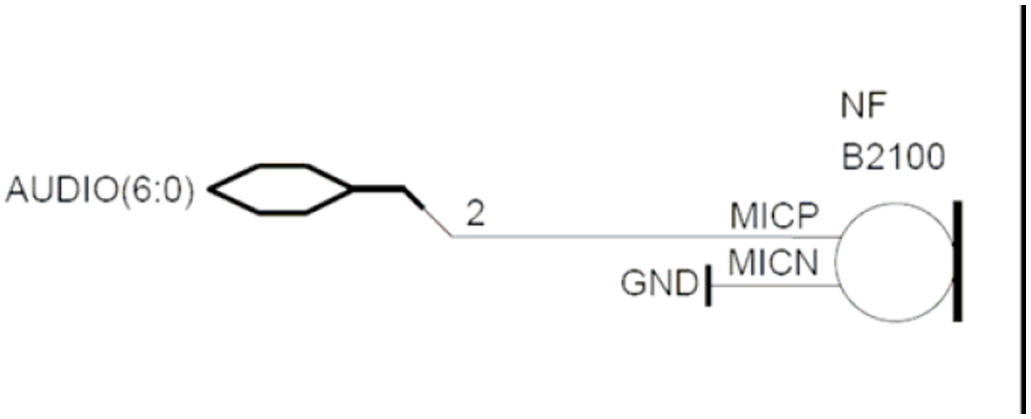

Figure 100 Internal microphone circuitry

External microphone

Galvanic accessories are connected to the system connector.

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Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

A dynamic 7mmx11mm earpiece capsule is connected directly to the EM ASIC (N2200) differential outputs EarP and EarN through the Slide flexi and the UI PWB.

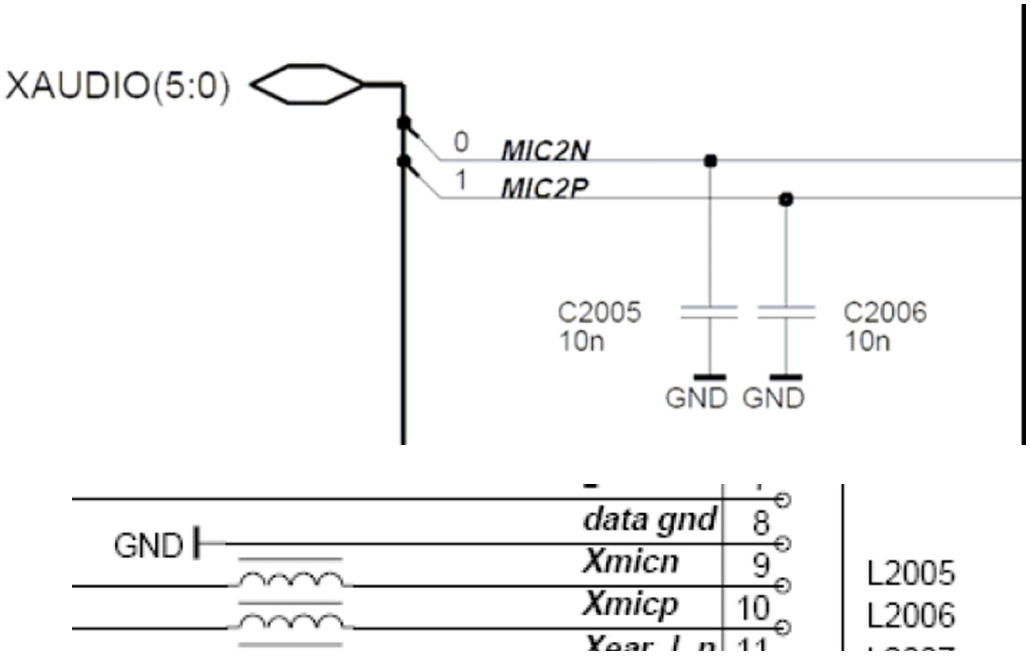

Figure 101 External microphone circuitry (system connector connects to the right side)

Internal earpiece

The internal earpiece is used in the HandPortable (HP) call mode. A dynamic 7mmx11mm earpiece capsule is connected directly to the EM ASIC (N2200) differential outputs EarP and EarN through the Slide flexi and the UI PWB.

Internal speaker

The internal speaker is used in Internal HandsFree (IHF) call mode.

A dynamic 16 mm speaker is connected to the EM ASIC (N2200) outputs HFSpP and HFSpN.

The IHF amplifier integrated in N2200 is a Digital Pulse Modulated Amplifier (DPMA).

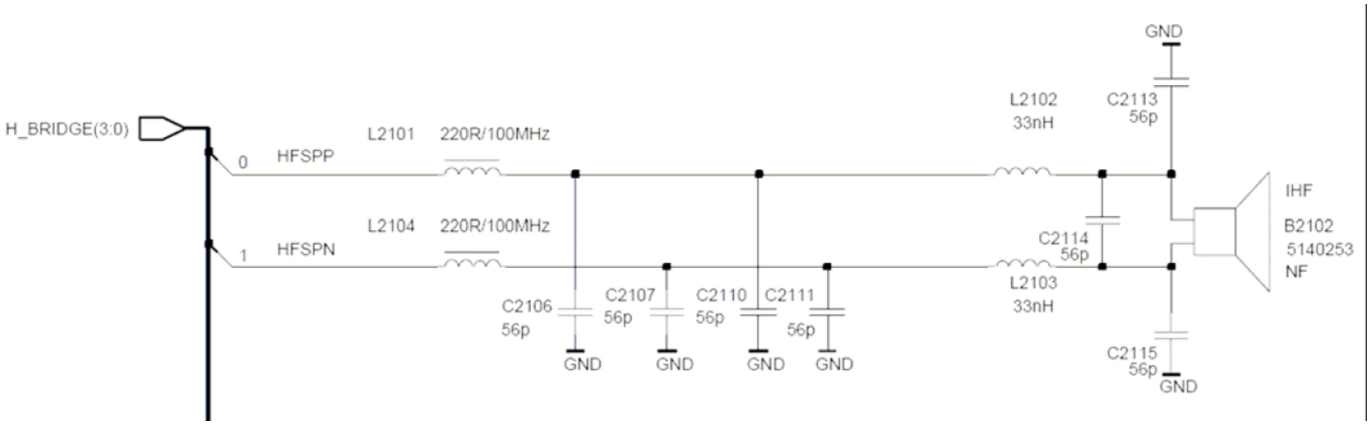

Figure 102 Internal speaker circuitry

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External earpiece

All galvanic accessories are connected to the system connector.

The accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

The EM ASIC (N2200) provides two output channels in either single-ended or differential format. N2200 outputs XearL and XearLC form the left channel audio output, and XearR and XearRC the right channel audio output. XearLC and XearRC are the ground pins if the output works in a single-ended operation.

In the system connector side, HSEAR P and HSEAR N form the left channel output, and HSEAR R P and HSEAR R N the right channel output. Respectively, HSEAR N and HSEAR R N are the ground pins if the output works in a single-ended operation.

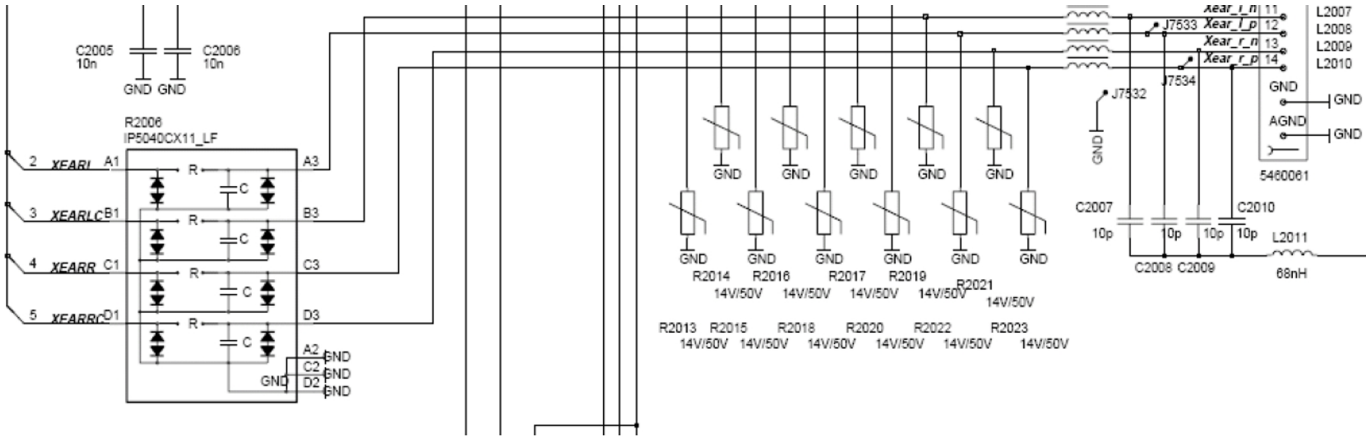

Figure 103 External earpiece circuitry (system connector connected on the right)

Vibra circuitry

Vibra is used for vibra-alarm function.

The vibra motor is connected to the EM ASIC (N2200) VibraP and VibraN Pulse Width Modulated (PWM) outputs.

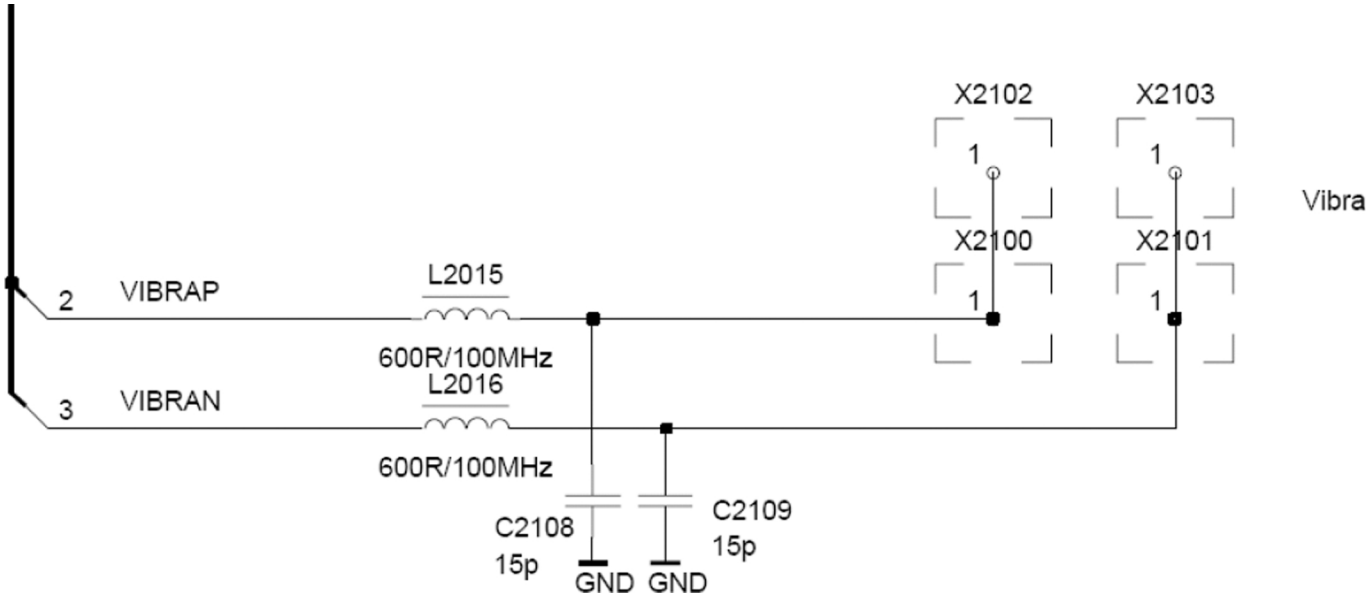

Figure 104 Vibra circuitry

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The vibra is connected to the engine PWB through springs attached to the Vibra motor body – X2100 and X2101 are hard gold plated contact pads on the PWB.

System connector

The system connector provides a fully differential 4–wire stereo line-level output connection and a fully differential 2-wire mono line-level or microphone level input connection.

The handsfree driver in N2200 is meant for the headset.

The output is driven in a fully differential mode. In the fully differential mode, the handsfree pin is the negative output and the HFCM pin is the positive output. The gain of the handsfree driver in the differential mode is 6 dB.

The earpiece and headset signals are multiplexed so that the outputs cannot be used simultaneously.

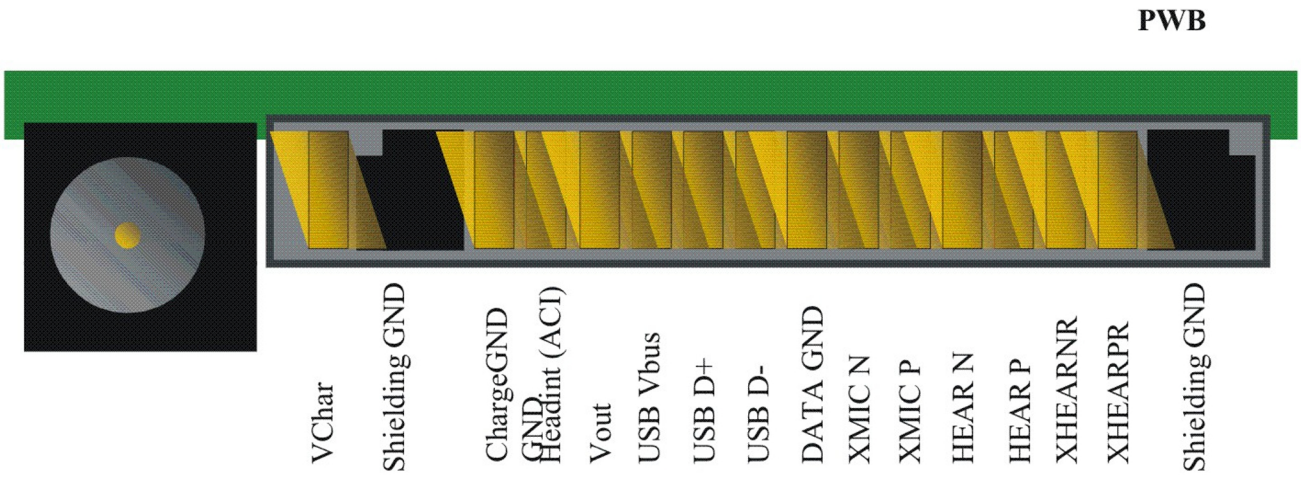

Figure 105 External audio connector

Table 17 Audio connector pin assignments

Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
1/ Charge	V Charge	DC	0-9V/ 0.85A		
2/ GND	Charge GND	-	0.85A	100mΩ (PWB+ conn.)	
3/ ACI	ACI	1kbits/s	Digital 0 / 2.5-2.78V	47Ω	Insertion & removal detection
4/ Vout	DC out	DC	2.78V 70 mA / 2.5V 90mA	100mΩ (PWB+ conn.)	200mW
9 / XMIC N	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
10 / XMIC P	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
11 / HEAR N	Audio out	20-20k	1Vpp	10Ω	
12 / HEAR P	Audio out	20-20k	1Vpp	10Ω	

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Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
13 / HEAR R N	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono
14 / HEAR R P	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono

Baseband technical specifications

External interfaces

External interfaces

Name of Connection	Connector reference
USB	X2001
Charger	X2000
Headset	X2001
SIM	X2700
RS MMC	X5200
Battery connector	X2070

ACI interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Accessory detection						
Headset detection threshold		1.75	1.9	2.05	V	N2200 specific
Headset detection hysteresis			25		mV	
Headset detection pull ups		1	2	4	uA	
After Mbus is switched to HeadDet						
High-level input voltage (VDDS = 1.8V)	V_{IH}	0.7 x V_{DDS}		V_{DDS}	V	RAP specific
Low-level input voltage	V_{IL}	0		0.3 x V_{DDS}	V	

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Description	Parameter	Min	Typ	Max	Unit	Notes
High-level output voltage	V_{OH}	0.8 x V_{DDS}		V_{DDS}	V	
Low-level output voltage	V_{OL}	0		0.22 x VDDS	V	
Rise/fall time	tR/tF			25	ns	

VOUT electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vout regulator for external accessories	VOUT	2.43	2.57	V	Max load 90mA

USB IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Absolute maximum voltage on D+ and D-	$V_{D+/D-}$	-1	4.6	V	USB specification revision 2.0
Supply voltage	VBUS	4.4	5.25	V	
Supply current:					
Functioning	I_{VBUS}		100	mA	
Suspended	I_{VBUS}		500	uA	
Unconfigured	I_{VBUS}		100	mA	
High-level input voltage:				V	
High (driven)	V_{IH}	2			
High (floating)	V_{IHZ}	2.7	3.6		
Low-level input voltage	V_{IL}		0.8	V	
Differential input sensitivity	V_{DI}	0.2		V	|(D+) - (D-)|
Differential input voltage range	V_{CM}	0.8	2.5	V	Included VDI range

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Description	Parameter	Min	Max	Unit	Notes
Low-level output voltage	V_{OL}	0	0.3	V	
High-level output voltage (driven)	V_{OH}	2.8	3.6	V	
Output signal crossover voltage	V_{CRS}	1.3	2	V	

FBUS interface electrical characteristics (between RAP and N2300)

Description	Parameter	Min	Max	Unit
High-level input voltage	V_{IH}	0.7 x V_{DDSHV2}	V_{DDSHV2}	V
Low-level Input voltage	V_{IL}	0	0.3 x V_{DDSHV2}	V
High-level output voltage	V_{OH}	0.8 x V_{DDSHV2}	V_{DDSHV2}	V
Low-level output voltage	V_{OL}	0	0.22 x V_{DDSHV2}	V
Rise/fall time	tR/tF	0	25	ns
(VDDSHV2 = 1.8V)				

Headset hook detection interface (XMICN) electrical characteristics

Description	Min	Typ	Max	Unit	Notes
Hook detection threshold 1	1.25	1.35	1.45	V	Two fixed thresholds inside N2200. Selectable by SW
Hook detection threshold 2	0.5	0.6	0.7	V	
Hook detection hysteresis		25		mV	
Hook detection pull ups	1	2	4	uA	

Audio signal electrical characteristics

Description	Parameter	Typ	Unit	Notes
XMIC N	Audio in	1	V_{pp}	DC Offset 2.5-2.78V
XMIC P	Audio in	1	V_{pp}	DC Offset 2.5-2.78V

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Description	Parameter	Typ	Unit	Notes
HSEAR N	Audio out	1	V_{pp}	10Ω nominal serial impedance
HSEAR P	Audio out	1	V_{pp}	10Ω nominal serial impedance
HSEAR R N	Audio out	1	V_{pp}	10Ω nominal serial impedance
				Not connected in mono
HSEAR R P	Audio out	1	V_{pp}	10Ω nominal serial impedance
				Not connected in mono

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	EM ASIC N2200	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
C2	SIMRST	Out	EM ASIC N2200	SIM1Rst	Reset signal to SIM card
C3	SIMCLK	Out	EM ASIC N2200	SIM1ClkC	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	EM ASIC N2200	SIM1DaC	Data input / output
SW	SIM_DET	In	EM ASIC N2200	SIMDetX	Removal detection

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Charger connector and charging interface connections & electrical characteristics

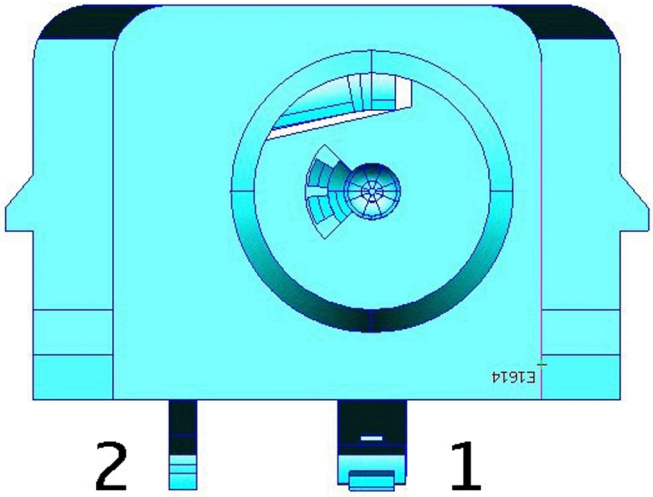

Figure 106 Charger connector

Table 18 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	N2300	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 19 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	9	V	Center pin
Vchar	I Charge		0.85	A	Center pin
Charge GND			0.85	A	
Threshold for charging, rising (N2300)	V_{MSTR+}	2.1		V	Typical value
Threshold for charging, falling (N2300)	V_{MSTR-}	1.9		V	Typical value

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Battery connector and interface connections & electrical characteristics

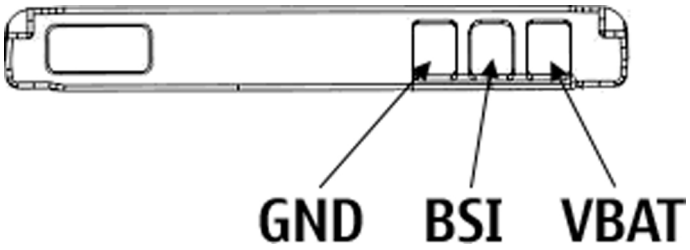

Figure 107 Battery connector

Table 20 Battery interface connections

Pin	Signal	I/O	Engine connection		Notes
1	VBAT	->	EM ASIC N2200	VBAT	Battery voltage
2	BSI	->	EM ASIC N2200	BSI	Battery size indication (fixed resistor inside the battery pack)
3	GND		GND		Ground

Table 21 Battery IF electrical characteristics

Description	Parameter	Max	Unit
Operation voltage	V_{IN}	4.23	VDC
Current rating	I_{IN}	0.9	A

Internal interfaces

Internal interfaces

Name of connection	Connector reference
Engine board	
Flexi connector	X4400
System connector	X2001
SIM connector	X2700
Vibra	X2100-X2103
Battery connector	X1100
Back camera	X6500
Flash connector	X6501
Power key	X4401,X4402
UI board	

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Name of connection	Connector reference
Flexi connector	X4
Display connector	X5
Front camera	X2
S60 UI connector	X3

UI module connector and IF connections

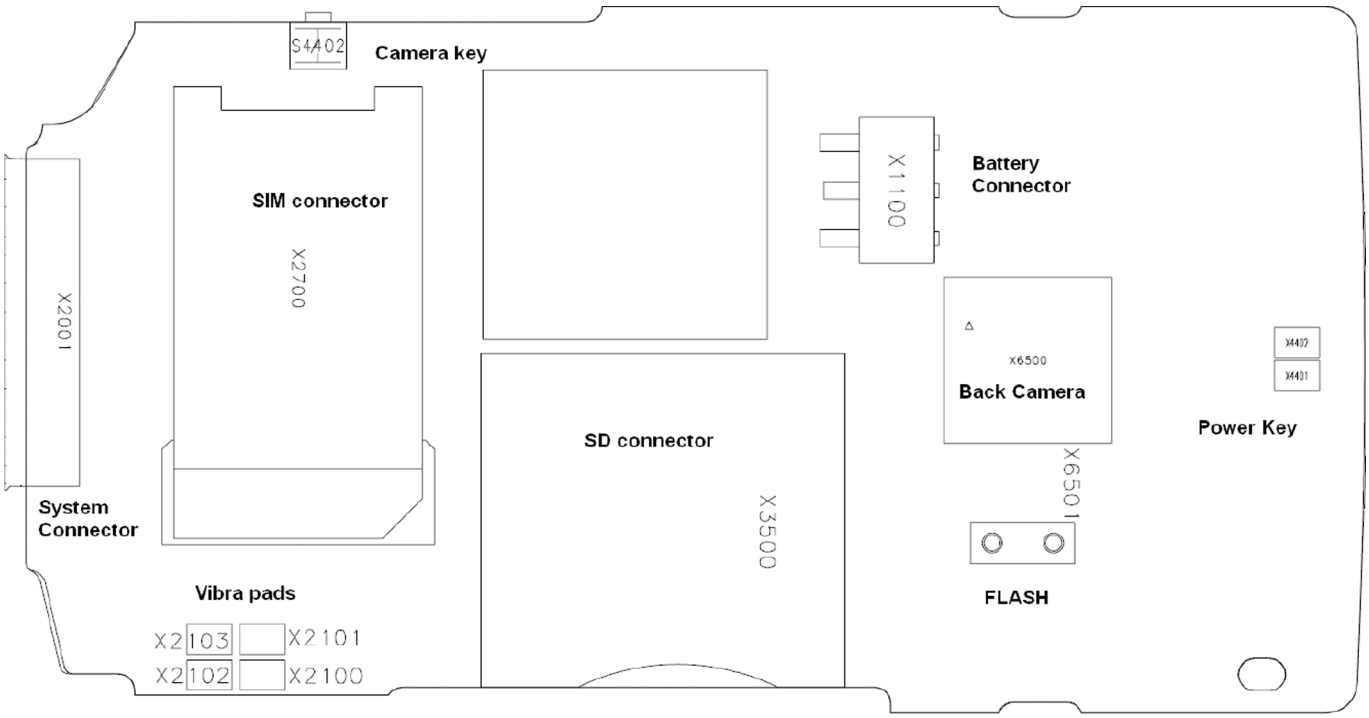

Figure 108 Back side of the board

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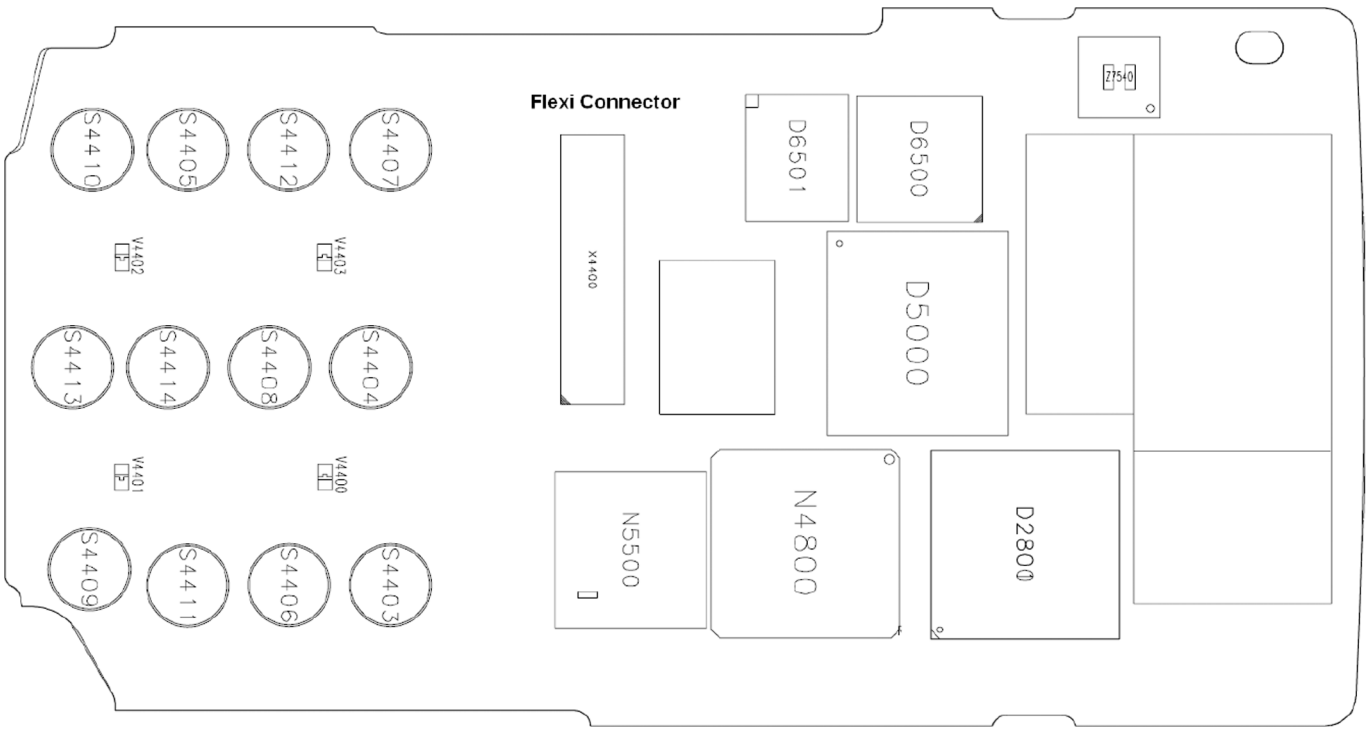

Figure 109 Front side of the board

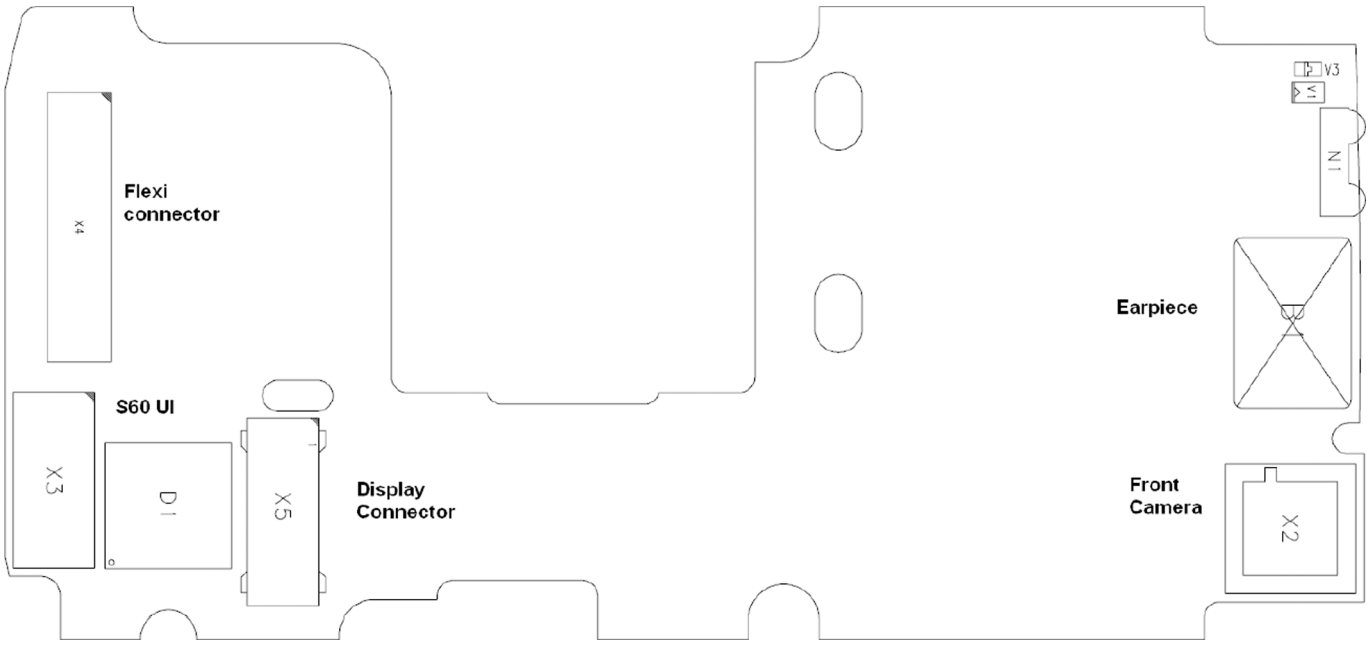

Figure 110 UI PWB connector references

Table 22 Flexi connector connections

Engine	Function	Dir	UI	Engine Connection		Notes
1	GND1	X	31	GND		
2	CAMSCL	->	33	Camera level shifter		2.8V logic
3	CAMRESET	->	32	Camera level shifter		2.8V logic

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Engine	Function	Dir	UI	Engine Connection		Notes
4	CAMHD	<-	30	Camera level shifter		2.8V logic
5	CAMVD	<-	28	Camera level shifter		2.8V logic
6	CAMDCLK	<-	29	Camera level shifter		2.8V logic
7	VBAT	->	27	VBAT		
8	CAMCLK	->	25	Camera level shifter		2.8V logic
9	CAMSDA	<->	26	Camera level shifter		2.8V logic
10	VCAM2V8	->	24	N4405		Camera 2.8V power supply
11	LCDTE	<-	21	APE	MESSI_VIDEO (21)	
12	SYSCLK	->	22	CMT ASIC	PUSL(6)	
13	GND	X	23	GND		
14	GND	X	18	GND		
15	LCDD15	->	19	APE	MESSI_VIDEO (15)	
16	GND2	X	20	GND		
17	LCDD11	->	15	APE	MESSI_VIDEO (11)	
18	LCDWRX	->	16	APE	MESSI_VIDEO (17)	
19	VAUX	->	17	N2200		
20	LCDD8	->	12	APE	MESSI_VIDEO (8)	
21	LCDD5	->	13	APE	MESSI_VIDEO (5)	
22	VLEDOUT	->	14	N2300		LED supply voltage for keymat and LCD
23	LCDD3	->	10	APE	MESSI_VIDEO (3)	
24	LCDD0	->	9	APE	MESSI_VIDEO (0)	
25	GND4	X	11	GND		

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Engine	Function	Dir	UI	Engine Connection		Notes
26	LCDD4	->	6	APE	MESSI_VIDEO (4)	
27	LCDD2	->	7	APE	MESSI_VIDEO (2)	
28	GND3	X	8	GND		
29	KBR0	<-	4	APE	KBR_0	
30	KBR1	<-	3	APE	KBR_1	
31	KBR5	<-	2	APE	KBR_5	
32	SETCURRKLED	<-	1	N2300		LED return for S60 keypad
33	KBR6	<-	68	APE	KBR_6	
34	KBC3	<-	69	APE	KBC_3	
35	VIO	->	70	N2200		
36	KBC2	<-	5	APE	KBC_2	
37	KBC1	<-	67	APE	KBC_1	
38	KBC0	<-	66	APE	KBC_0	
39	LOSSI_DOUT	->	65	APE	SPI_K2(1)	
40	LOSSI_DIN	<-	64	APE	SPI_K2(2)	
41	SETCURRDLED	<-	63	V4405		LED return for LCD
42	LOSSI_CLK	->	62	APE	SPI_K2(0)	
43	LOSSI_CS	->	61	APE	SPI_K2(3)	
44	FLASH_LED	->	60	CMT ASIC		
45	LCDD1	->	59	APE	MESSI_VIDEO (1)	
46	LCDD6	->	58	APE	MESSI_VIDEO (6)	
47	LCDD7	->	57	APE	MESSI_VIDEO (7)	
48	LCDD10	->	56	APE	MESSI_VIDEO (10)	
49	LCDD9	->	55	APE	MESSI_VIDEO (9)	
50	LCDD12	->	54	APE	MESSI_VIDEO (12)	
51	LCDD13	->	53	APE	MESSI_VIDEO (13)	

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Engine	Function	Dir	UI	Engine Connection		Notes
52	LCDD14	->	52	APE	MESSI_VIDEO (14)	
53	LCDCMD	->	51	APE	MESSI_VIDEO (19)	
54	LCDRDX	->	50	APE	MESSI_VIDEO (18)	
55	LCDRSTX	->	49	APE	MESSI_VIDEO (20)	
56	CAMD7	<-	48	Camera level shifter		2.8V logic
57	CAMD6	<-	47	Camera level shifter		2.8V logic
58	CAMD5	<-	46	Camera level shifter		2.8V logic
59	CAMD4	<-	45	Camera level shifter		2.8V logic
60	CAMD3	<-	44	Camera level shifter		2.8V logic
61	CAMD2	<-	43	Camera level shifter		2.8V logic
62	CAMD1	<-	42	Camera level shifter		2.8V logic
63	CAMD0	<-	41	Camera level shifter		2.8V logic
64	IRRXD	<-	40	APE	IRDA_APE(0)	
65	IRTXD	->	39	APE	IRDA_APE(1)	
66	IRSD	->	38	APE	IRDA_APE(2)	
67	EARP	->	37	N2200	AUDIO(0)	
68	EARN	->	36	N2200	AUDIO(1)	
69	ALDTS	<-	35	N2200	ALD_TS	
70	ALD	<-	34	N2200	ALD_TS	

Note: The flexi does not map pin numbers 1:1 at each end.

Keyboard interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage	V_{IH}	0.65* V_{DDS}	V_{DDS}	0.3+ V_{DDS}	V	Row
Low-level input voltage	V_{IL}	-0.3	0	0.35* V_{DDS}	V	Row

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Description	Parameter	Min	Typ	Max	Unit	Notes
High-level output voltage	V_{OH}	1.62	V_{DDS}	1.98	V	Column
Low-level output voltage	V_{OL}		0	0.45	V	Column
(VDDS = 1.8V)						

Display connector and interface connections

Table 23 S60 connector pin assignment from main UI board

Pin	Signal	I/O	Engine connection		Notes
1	GND	X	GND		
2	GND	X	GND		
3	COL0	->	APE	KBC_0	
4	ROW6	->	APE	KBR_6	
5	COL1	->	APE	KBC_0	
6	ROW5	->	APE	KBR_5	
7	COL2	->	APE	KBC_2	
8	GND	X	GND		
9	GND	X	GND		
10	ROW1	->	APE	KBR_1	
11	COL3	->	APE	KBC_3	
12	ROW0	->	APE	KBR_0	
13	LEDOUT	<-	N2300		LED driving voltage
14	SETCURRK LED	->	N2300		LED return current.
15	GND	X	GND		
16	GND	X	GND		

Back camera electrical characteristics

Table 24 Camera CCP IF electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Common mode voltage	VCMF	0.8	0.9	1	V	-1
Differential voltage swing	VOD	100	150	250	mV	-2
Operating frequency	fCLK	1		175	MHz	SW controls frequency

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Description	Parameter	Min	Typ	Max	Unit	Notes
Differential rise and fall time		300		800	ps	-3

Note:

- Common mode voltage is a mean value of high and low states of one single-ended signal.
- Differential voltage swing is differential amplitude between signals of differential pair.
- Differential transitions should be only measured with good equipment (bandwidth > 1 GHz), otherwise results will seem too slow.

Table 25 Camera supply voltage characteristics

Description	Parameter	Min	Typ	Max	Unit
Camera analogue voltage	VDD	2.37	2.5	2.63	V
Camera digital voltage	VDDI	1.4	1.5	1.65V	V

Table 26 Camera control IF electrical characteristics

Description	Parameter	Min	Typ.	Max	Unit	Notes
SDA, SCL, Vctrl, ExtClk	VIH	1.5	1.8	VDD	V	High-level input voltage
SDA, SCL, Vctrl, ExtClk	VIL	0	-	0.54	V	Low-level input voltage
SDA	VOL	0	-	0.4	V	High-level output voltage
Regulator Enable	VOH	1.35	1.8	2.3V	V	D4800 GPIO High-level output voltage
Cam_strobe	VOH	0.8 x VDD	-	VDD		High-level output voltage
Cam_strobe	VOL	0	-	0.4	V	Low-level output voltage
ExtClk	fExtClk		9.6		MHz	SW controls frequency
SDA, SCL	tR			300	ns	Rise time

Front camera electrical characteristics

Table 27 Front camera supply voltage characteristics

Description	Parameter	Min	Typ	Max	Unit
Camera I/O and photo sensor voltage	VCAM2	2.6	2.8	3	V
Camera digital circuits and A/D converter voltage	VCAM	1.4	1.5	1.6	V

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Flash LED interface and electrical characteristics

Table 28 Flash LED interface connections

Signal name	From	To	Description
GPIO28	D4800	N1471	Indicator mode enable signal
ARMIO4	D4800	N1471, V1472	Flash mode enable test signal (only test use)
VBAT	Battery	N1471	Battery nominal voltage
STROBE	Camera	N1471, V1472	Flash light enable signal from back camera

Table 29 Flash LED interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
GPIO28	GPIO output	1.72	1.8	1.92	V
ARMIO4	GPIO output	1.72	1.8	1.92	V
STROBE	Strobe signal output	2	-	2.5	V

Slider switch electrical characteristics

Signal name	From	To	Low value	High value	Description
GPIO53	Application processor	S5202	160 mV	1.8 V	Slider switch cover status signal.

Back-up battery interface connections and electrical characteristics

Table 30 Back-up battery connections

Pin name	I/O	Connection	Notes
L2207, VBack	->	N2200, VBack	Back-up battery G2200 is connected to N2200 via coil

Table 31 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.5	2.7	V

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RF description

RF introduction

This section describes the RF modules of the RM-91/92 engine. RM-92 uses RF ASIC N7500 and RM-91 uses RF ASIC N7505.

The RF is controlled by digital baseband circuitry via a serial bus (RFBus). The RFBus is for mode selection, frequency synthesizer control, RX AGC setting, RF regulator control, TX power control loop and PA bias control. In addition to RFBus there are also several other interface signals coming from BB. TX power control (TXC), VCTCXO frequency control (AFC) and some other control signals (voltage and current references, WCDMA TX power detection, PA combination detection).

Regulators

All RF regulators, except one, are located in the EM ASIC N2200 in the baseband section or in the RF ASIC of the device. The discreet regulator, N7541, feeds the WCDMA PA. The EM ASIC N2200 has three regulators for RF:

- 2.5 V regulator VXO
- 4.75 V regulator VCP (VCP1 & VCP2)
- 1.35 V regulator, VB_EXT, which is the reference voltage.

Block diagrams

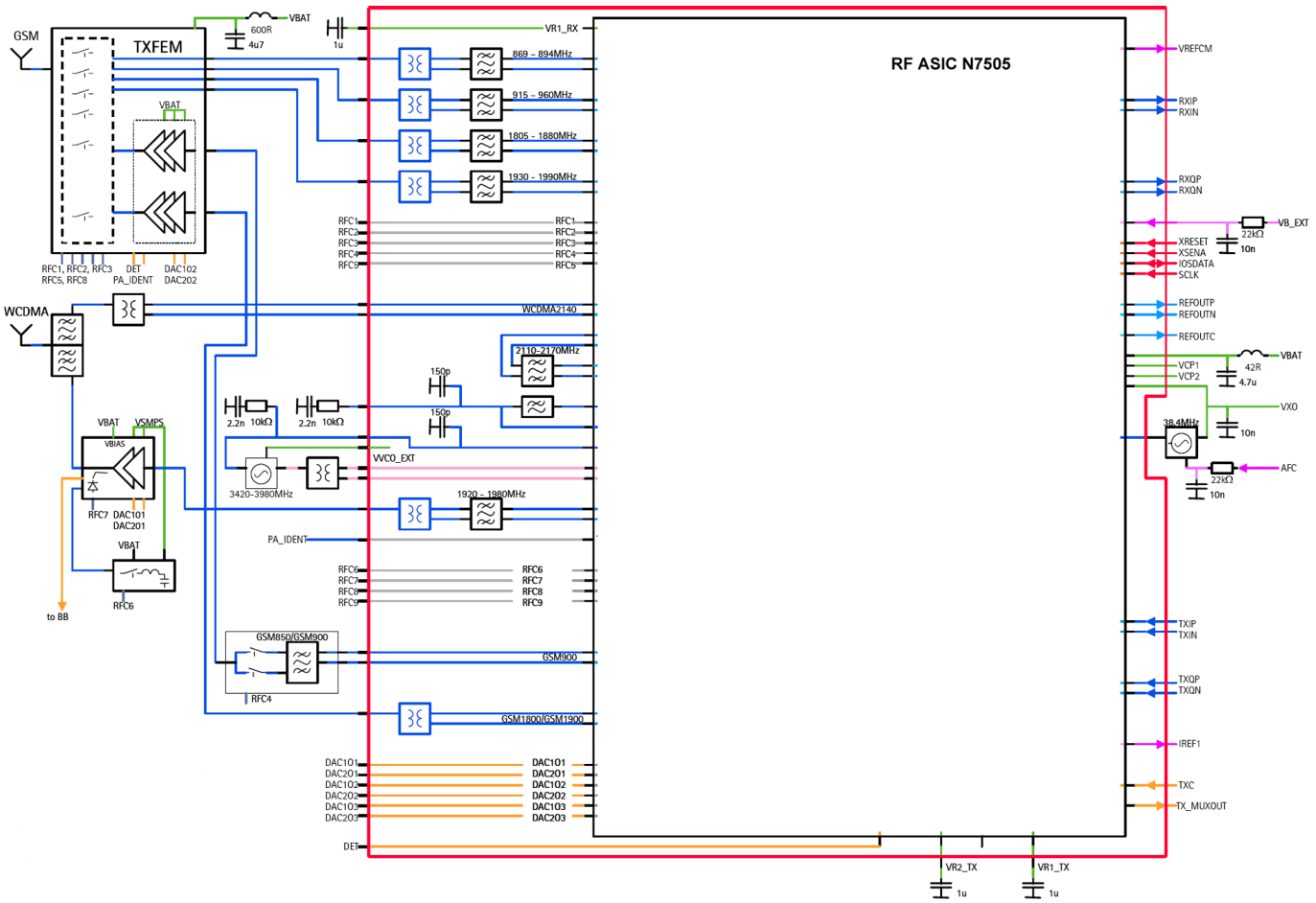

Figure 111 RF block diagram RM-92 using RF ASIC N7500

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The RF block diagram for RM-92 uses RF ASIC N7500 as illustrated by the red border in the block diagram. It can be seen that the module contains RF ASIC N7505 and all the baluns and filters, except GSM TX filters and the WCDMA balun. This implementation is used for WCDMA 2100.

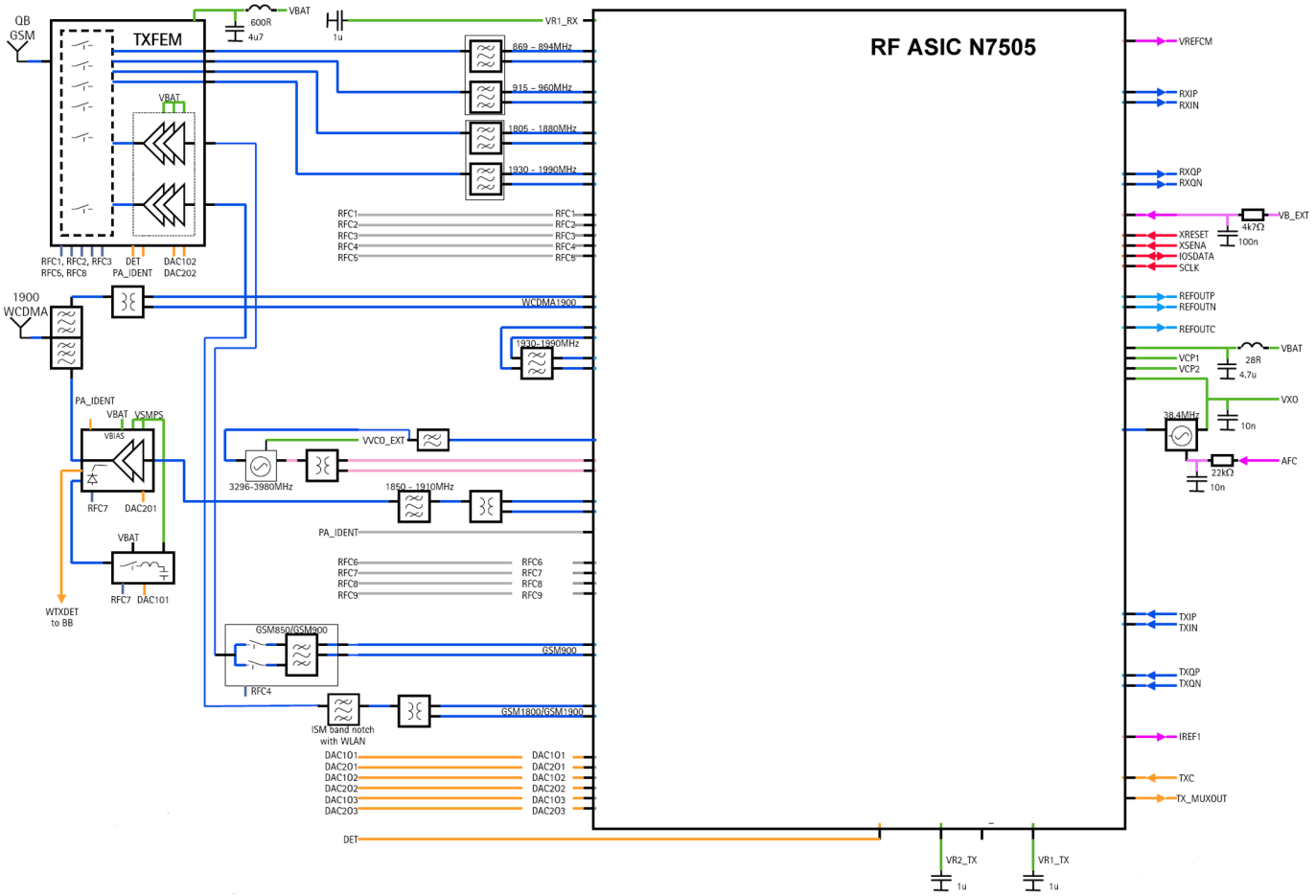

Figure 112 RF block diagram RM-91 using RF ASIC N7505

The RF block diagram for RM-91 uses RF ASIC N7505 that performs the RF back-end functions of receive and transmit function of the cellular transceiver. This implementation is used for WCDMA 1900.

Frequency plan

Both, the receiver and the transmitter, are based on direct conversion architecture. The VCOs operate at the channel frequency multiplied by two or four depending on the band of operation. This means that the modulated baseband signals are directly converted up to the transmission frequency and the received RF signals directly down to the baseband frequency.

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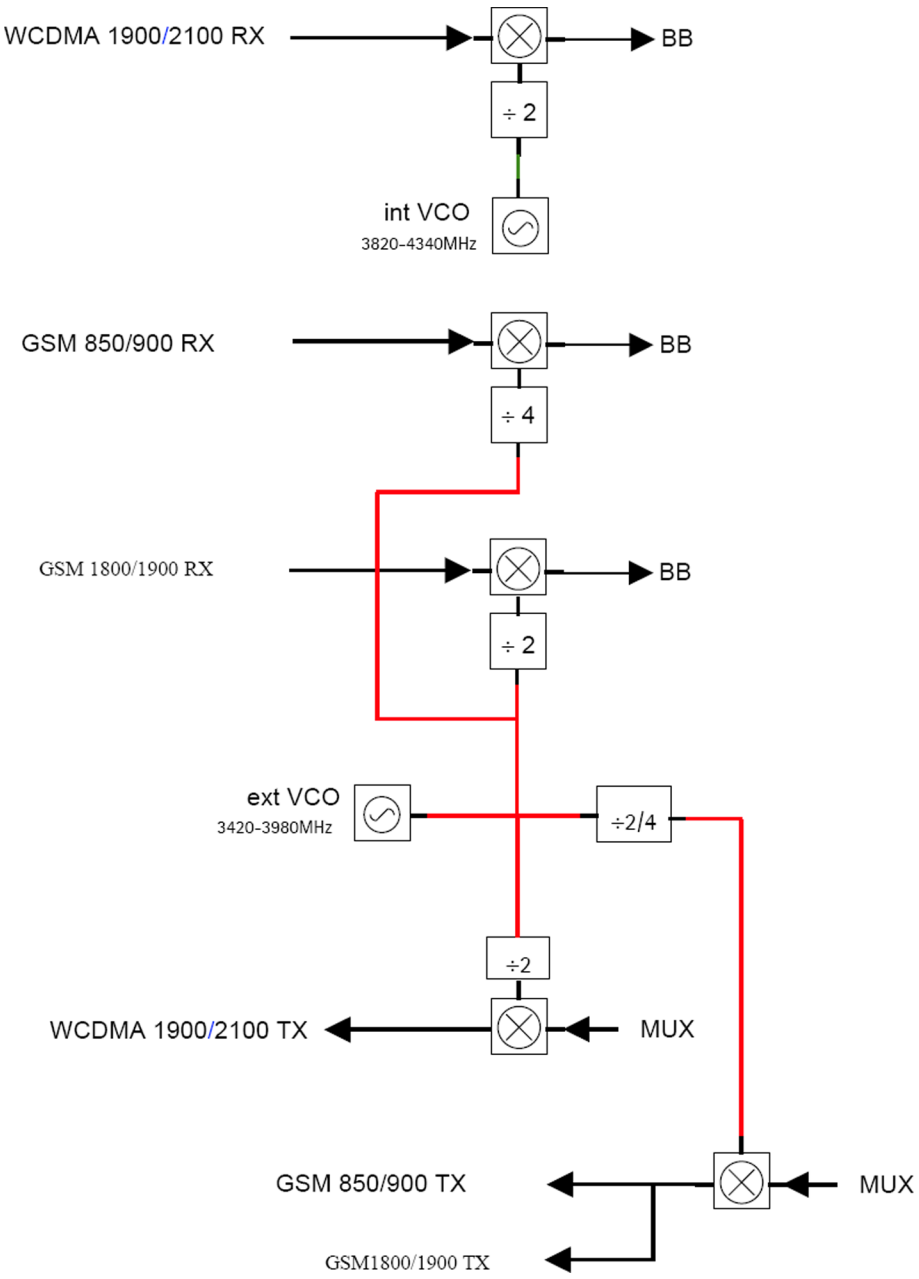

Figure 113 RF frequency plan

Receiver

Introduction to receiver functionality

In RM-92, receiver functions are implemented in RF ASIC N7500, in RM-91, in RF ASIC N7505.

The receiver is a linear direct conversion receiver containing LNA, band pass filter and demodulator for each supported system and band. After the demodulators the signal paths are combined to one common BB path.

WCDMA receiver

In WCDMA mode, the received signal is fed from the antenna to the BAW duplex filter. From the duplex filter, the signal goes through a balun to the integrated LNA in the RF ASIC. From the LNA the signal goes through a band pass filter. After filtering, the signal goes to the down conversion mixer, which converts the signal into baseband I and Q signals.

At BB frequency the signal is amplified and fed to a low pass filters.

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The filter is followed by an AGC amplifier with adjustable gain. The signal is further amplified before it is fed to balanced analog IQ output pins. Analog output pins are accompanied by reference voltage output, which sets the DC level for the AD converter in BB ASIC.

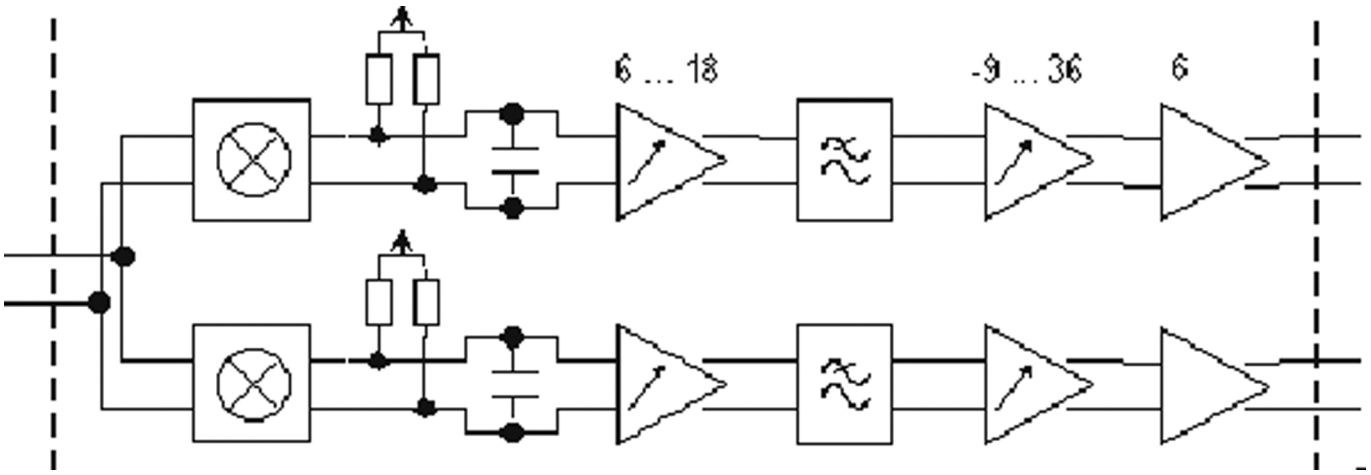

Figure 114 WCDMA receiver after duplexer, LNA and SAW filter

GSM receiver

As GSM850, GSM900, GSM1800 and GSM1900 RX branches are functionally identical, the following description is applicable to all of them.

The received signal goes from the GSM antenna to the antenna switch module. The switch module contains PIN diode switches for band and RX/TX. The antenna switch module is followed by integrated LNA stages in the RF ASIC. The LNAs are followed by demodulators which downconvert the signal to baseband I and Q signals.

In the BB-chain there are two adjustable gain stages and one mode specific gain. The first one called BB-gain is just after the demodulator. It has a 12 dB gain range with 6dB steps. After the BB-gain there is the channel select filter.

Main AGC amplifier proceeds the channel selection filter. It has 30 dB of gain control range with 3 dB steps. Final amplifier stage is used as an output buffer for IQ signals. This stage is set to 0 dB gain in GSM mode.

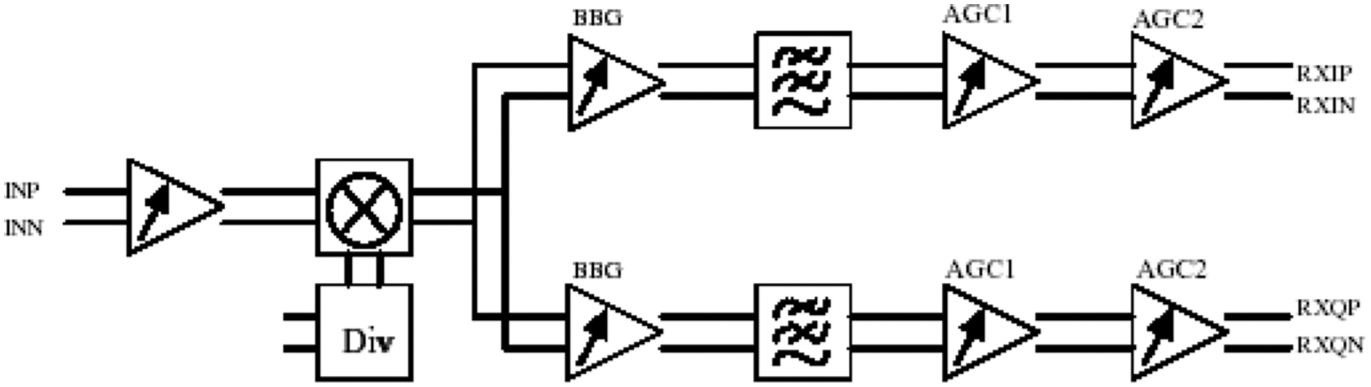

Figure 115 GSM receiver after the antenna switch

Transmitter

Introduction to transmitter functionality

In RM-92, transmitter functions are implemented in the RF ASIC N7500, in RM-91, in RF ASIC N7505.

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The RF ASICs contain a BB frequency low pass filter, which is tunable according the signal bandwidth of the system in use. In addition, they both contain three separate RF paths (GSM850/900, GSM1800/1900 and WCDMA) comprising of a final frequency IQ modulator and VGA amplifiers.

WCDMA transmitter

In the transmitter side, an analogue I/Q modulated signal is fed from the digital baseband into the RF ASIC and through the low pass filter. After the filter the signal is fed to the I/Q modulator, which converts the signal to final TX frequency. There are two separate I/Q modulators, one for WCDMA and another for GSM850/EGSM900 and GSM1800/1900 signals. The WCDMA branch is selected by biasing the appropriate modulator. The modulator is followed by two VGA stages. The signal then exits the RF ASIC via a balanced line. The signal is band pass filtered by a SAW filter before it is fed to WCDMA PA module.

After the PA, the transmitted WCDMA signal is fed through the duplex filter to the antenna.

WCDMA power control

WCDMA TX power control is performed by the two VGA stages in the RF ASIC.

The gain of VGA amplifier chain is controlled by a DA converter in BB. The same DA converter is shared by GSM TX power control function.

WCDMA PA module

WCDMA PA is housed in a separate module having a variable supply voltage input for the amplifier stages (Vcc11), a battery supply voltage for the bias circuits (Vcc12) and one bias current input. Bias current is generated by 5 bit DA (DAC201) converter in RF ASIC N7500. The converter is controlled via RFBus.

In production the PA quiescent current can be tuned to target value by adjusting the bias current of PA output stage. The bias current is also used as PA on/off controls.

PA DCDC converter

The DCDC converter is controlled by 5 bit DA (DAC101) converter in RF ASIC N7500. The converter is controlled via RFBus. The DCDC converter limits the lowest supply voltage to 1.3 V. At the highest power levels, the DCDC converter output settles nominally to 3.1 V.

GSM transmitter

An analog IQ modulated signal is fed to the RF ASIC from Digital BB. It is first low pass filtered then routed to the GSM modulator. The appropriate routing after the modulator is selected by biasing either GSM850/EGSM900 or GSM1800/1900 variable gain amplifier.

After the VGA stage, the signal exits the RF ASIC. In case of GSM1800/1900, the signal goes directly to the GSM PA module. In case of GSM850/EGSM900, the PA module is preceded by a switchable SAW filter. After the filter, the signal is fed to GSM TX front-end module (TXFEM), which also contains the antenna switch.

GSM PA module

The TXFEM module contains two separate amplifier chains, one for GSM850/EGSM900 and another for GSM1800/1900. Both amplifiers have a battery supply connection and two bias current inputs.

Frequency synthesizers

There are two separate synthesizers for WCDMA Rx and WCDMA Tx / GSM Tx / Rx. This allows the duplex separation to be set according the network settings in the WCDMA mode.

The VCOs are locked by PLLs into a reference oscillator, VCTCXO (Voltage Controlled Temperature Compensated Crystal Oscillator).

The PLLs are located in RF ASICs and controlled via RFBus.

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Reference oscillator

A 38.4MHz VCTCXO is used as a reference oscillator for the frequency synthesizers.

The frequency of the reference oscillator is locked into the frequency of the base station with the help of an AFC voltage, which is generated in BB by DSP and converted by dedicated DAC.

Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

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EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

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GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

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GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

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WCDMA 2100 Rx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX
10562	2112.4	4224.8	10625	2125	4250	10688	2137.6	4275.2	10751	2150.2	4300.4	10814	2162.8	4325.6
10563	2112.6	4225.2	10626	2125.2	4250.4	10689	2137.8	4275.6	10752	2150.4	4300.8	10815	2163	4326
10564	2112.8	4225.6	10627	2125.4	4250.8	10690	2138	4276	10753	2150.6	4301.2	10816	2163.2	4326.4
10565	2113	4226	10628	2125.6	4251.2	10691	2138.2	4276.4	10754	2150.8	4301.6	10817	2163.4	4326.8
10566	2113.2	4226.4	10629	2125.8	4251.6	10692	2138.4	4276.8	10755	2151	4302	10818	2163.6	4327.2
10567	2113.4	4226.8	10630	2126	4252	10693	2138.6	4277.2	10756	2151.2	4302.4	10819	2163.8	4327.6
10568	2113.6	4227.2	10631	2126.2	4252.4	10694	2138.8	4277.6	10757	2151.4	4302.8	10820	2164	4328
10569	2113.8	4227.6	10632	2126.4	4252.8	10695	2139	4278	10758	2151.6	4303.2	10821	2164.2	4328.4
10570	2114	4228	10633	2126.6	4253.2	10696	2139.2	4278.4	10759	2151.8	4303.6	10822	2164.4	4328.8
10571	2114.2	4228.4	10634	2126.8	4253.6	10697	2139.4	4278.8	10760	2152	4304	10823	2164.6	4329.2
10572	2114.4	4228.8	10635	2127	4254	10698	2139.6	4279.2	10761	2152.2	4304.4	10824	2164.8	4329.6
10573	2114.6	4229.2	10636	2127.2	4254.4	10699	2139.8	4279.6	10762	2152.4	4304.8	10825	2165	4330
10574	2114.8	4229.6	10637	2127.4	4254.8	10700	2140	4280	10763	2152.6	4305.2	10826	2165.2	4330.4
10575	2115	4230	10638	2127.6	4255.2	10701	2140.2	4280.4	10764	2152.8	4305.6	10827	2165.4	4330.8
10576	2115.2	4230.4	10639	2127.8	4255.6	10702	2140.4	4280.8	10765	2153	4306	10828	2165.6	4331.2
10577	2115.4	4230.8	10640	2128	4256	10703	2140.6	4281.2	10766	2153.2	4306.4	10829	2165.8	4331.6
10578	2115.6	4231.2	10641	2128.2	4256.4	10704	2140.8	4281.6	10767	2153.4	4306.8	10830	2166	4332
10579	2115.8	4231.6	10642	2128.4	4256.8	10705	2141	4282	10768	2153.6	4307.2	10831	2166.2	4332.4
10580	2116	4232	10643	2128.6	4257.2	10706	2141.2	4282.4	10769	2153.8	4307.6	10832	2166.4	4332.8
10581	2116.2	4232.4	10644	2128.8	4257.6	10707	2141.4	4282.8	10770	2154	4308	10833	2166.6	4333.2
10582	2116.4	4232.8	10645	2129	4258	10708	2141.6	4283.2	10771	2154.2	4308.4	10834	2166.8	4333.6
10583	2116.6	4233.2	10646	2129.2	4258.4	10709	2141.8	4283.6	10772	2154.4	4308.8	10835	2167	4334
10584	2116.8	4233.6	10647	2129.4	4258.8	10710	2142	4284	10773	2154.6	4309.2	10836	2167.2	4334.4
10585	2117	4234	10648	2129.6	4259.2	10711	2142.2	4284.4	10774	2154.8	4309.6	10837	2167.4	4334.8
10586	2117.2	4234.4	10649	2129.8	4259.6	10712	2142.4	4284.8	10775	2155	4310	10838	2167.6	4335.2
10587	2117.4	4234.8	10650	2130	4260	10713	2142.6	4285.2	10776	2155.2	4310.4			
10588	2117.6	4235.2	10651	2130.2	4260.4	10714	2142.8	4285.6	10777	2155.4	4310.8			
10589	2117.8	4235.6	10652	2130.4	4260.8	10715	2143	4286	10778	2155.6	4311.2			
10590	2118	4236	10653	2130.6	4261.2	10716	2143.2	4286.4	10779	2155.8	4311.6			
10591	2118.2	4236.4	10654	2130.8	4261.6	10717	2143.4	4286.8	10780	2156	4312			
10592	2118.4	4236.8	10655	2131	4262	10718	2143.6	4287.2	10781	2156.2	4312.4			
10593	2118.6	4237.2	10656	2131.2	4262.4	10719	2143.8	4287.6	10782	2156.4	4312.8			
10594	2118.8	4237.6	10657	2131.4	4262.8	10720	2144	4288	10783	2156.6	4313.2			
10595	2119	4238	10658	2131.6	4263.2	10721	2144.2	4288.4	10784	2156.8	4313.6			
10596	2119.2	4238.4	10659	2131.8	4263.6	10722	2144.4	4288.8	10785	2157	4314			
10597	2119.4	4238.8	10660	2132	4264	10723	2144.6	4289.2	10786	2157.2	4314.4			
10598	2119.6	4239.2	10661	2132.2	4264.4	10724	2144.8	4289.6	10787	2157.4	4314.8			
10599	2119.8	4239.6	10662	2132.4	4264.8	10725	2145	4290	10788	2157.6	4315.2			
10600	2120	4240	10663	2132.6	4265.2	10726	2145.2	4290.4	10789	2157.8	4315.6			
10601	2120.2	4240.4	10664	2132.8	4265.6	10727	2145.4	4290.8	10790	2158	4316			
10602	2120.4	4240.8	10665	2133	4266	10728	2145.6	4291.2	10791	2158.2	4316.4			
10603	2120.6	4241.2	10666	2133.2	4266.4	10729	2145.8	4291.6	10792	2158.4	4316.8			
10604	2120.8	4241.6	10667	2133.4	4266.8	10730	2146	4292	10793	2158.6	4317.2			
10605	2121	4242	10668	2133.6	4267.2	10731	2146.2	4292.4	10794	2158.8	4317.6			
10606	2121.2	4242.4	10669	2133.8	4267.6	10732	2146.4	4292.8	10795	2159	4318			
10607	2121.4	4242.8	10670	2134	4268	10733	2146.6	4293.2	10796	2159.2	4318.4			
10608	2121.6	4243.2	10671	2134.2	4268.4	10734	2146.8	4293.6	10797	2159.4	4318.8			
10609	2121.8	4243.6	10672	2134.4	4268.8	10735	2147	4294	10798	2159.6	4319.2			
10610	2122	4244	10673	2134.6	4269.2	10736	2147.2	4294.4	10799	2159.8	4319.6			
10611	2122.2	4244.4	10674	2134.8	4269.6	10737	2147.4	4294.8	10800	2160	4320			
10612	2122.4	4244.8	10675	2135	4270	10738	2147.6	4295.2	10801	2160.2	4320.4			
10613	2122.6	4245.2	10676	2135.2	4270.4	10739	2147.8	4295.6	10802	2160.4	4320.8			
10614	2122.8	4245.6	10677	2135.4	4270.8	10740	2148	4296	10803	2160.6	4321.2			
10615	2123	4246	10678	2135.6	4271.2	10741	2148.2	4296.4	10804	2160.8	4321.6			
10616	2123.2	4246.4	10679	2135.8	4271.6	10742	2148.4	4296.8	10805	2161	4322			
10617	2123.4	4246.8	10680	2136	4272	10743	2148.6	4297.2	10806	2161.2	4322.4			
10618	2123.6	4247.2	10681	2136.2	4272.4	10744	2148.8	4297.6	10807	2161.4	4322.8			
10619	2123.8	4247.6	10682	2136.4	4272.8	10745	2149	4298	10808	2161.6	4323.2			
10620	2124	4248	10683	2136.6	4273.2	10746	2149.2	4298.4	10809	2161.8	4323.6			
10621	2124.2	4248.4	10684	2136.8	4273.6	10747	2149.4	4298.8	10810	2162	4324			
10622	2124.4	4248.8	10685	2137	4274	10748	2149.6	4299.2	10811	2162.2	4324.4			
10623	2124.6	4249.2	10686	2137.2	4274.4	10749	2149.8	4299.6	10812	2162.4	4324.8			
10624	2124.8	4249.6	10687	2137.4	4274.8	10750	2150	4300	10813	2162.6	4325.2			

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WCDMA 2100 Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
9612	1922.4	3844.8	9671	1934.2	3868.4	9730	1946	3892	9789	1957.8	3915.6	9848	1969.6	3939.2
9613	1922.6	3845.2	9672	1934.4	3868.8	9731	1946.2	3892.4	9790	1958	3916	9849	1969.8	3939.6
9614	1922.8	3845.6	9673	1934.6	3869.2	9732	1946.4	3892.8	9791	1958.2	3916.4	9850	1970	3940
9615	1923	3846	9674	1934.8	3869.6	9733	1946.6	3893.2	9792	1958.4	3916.8	9851	1970.2	3940.4
9616	1923.2	3846.4	9675	1935	3870	9734	1946.8	3893.6	9793	1958.6	3917.2	9852	1970.4	3940.8
9617	1923.4	3846.8	9676	1935.2	3870.4	9735	1947	3894	9794	1958.8	3917.6	9853	1970.6	3941.2
9618	1923.6	3847.2	9677	1935.4	3870.8	9736	1947.2	3894.4	9795	1959	3918	9854	1970.8	3941.6
9619	1923.8	3847.6	9678	1935.6	3871.2	9737	1947.4	3894.8	9796	1959.2	3918.4	9855	1971	3942
9620	1924	3848	9679	1935.8	3871.6	9738	1947.6	3895.2	9797	1959.4	3918.8	9856	1971.2	3942.4
9621	1924.2	3848.4	9680	1936	3872	9739	1947.8	3895.6	9798	1959.6	3919.2	9857	1971.4	3942.8
9622	1924.4	3848.8	9681	1936.2	3872.4	9740	1948	3896	9799	1959.8	3919.6	9858	1971.6	3943.2
9623	1924.6	3849.2	9682	1936.4	3872.8	9741	1948.2	3896.4	9800	1960	3920	9859	1971.8	3943.6
9624	1924.8	3849.6	9683	1936.6	3873.2	9742	1948.4	3896.8	9801	1960.2	3920.4	9860	1972	3944
9625	1925	3850	9684	1936.8	3873.6	9743	1948.6	3897.2	9802	1960.4	3920.8	9861	1972.2	3944.4
9626	1925.2	3850.4	9685	1937	3874	9744	1948.8	3897.6	9803	1960.6	3921.2	9862	1972.4	3944.8
9627	1925.4	3850.8	9686	1937.2	3874.4	9745	1949	3898	9804	1960.8	3921.6	9863	1972.6	3945.2
9628	1925.6	3851.2	9687	1937.4	3874.8	9746	1949.2	3898.4	9805	1961	3922	9864	1972.8	3945.6
9629	1925.8	3851.6	9688	1937.6	3875.2	9747	1949.4	3898.8	9806	1961.2	3922.4	9865	1973	3946
9630	1926	3852	9689	1937.8	3875.6	9748	1949.6	3899.2	9807	1961.4	3922.8	9866	1973.2	3946.4
9631	1926.2	3852.4	9690	1938	3876	9749	1949.8	3899.6	9808	1961.6	3923.2	9867	1973.4	3946.8
9632	1926.4	3852.8	9691	1938.2	3876.4	9750	1950	3900	9809	1961.8	3923.6	9868	1973.6	3947.2
9633	1926.6	3853.2	9692	1938.4	3876.8	9751	1950.2	3900.4	9810	1962	3924	9869	1973.8	3947.6
9634	1926.8	3853.6	9693	1938.6	3877.2	9752	1950.4	3900.8	9811	1962.2	3924.4	9870	1974	3948
9635	1927	3854	9694	1938.8	3877.6	9753	1950.6	3901.2	9812	1962.4	3924.8	9871	1974.2	3948.4
9636	1927.2	3854.4	9695	1939	3878	9754	1950.8	3901.6	9813	1962.6	3925.2	9872	1974.4	3948.8
9637	1927.4	3854.8	9696	1939.2	3878.4	9755	1951	3902	9814	1962.8	3925.6	9873	1974.6	3949.2
9638	1927.6	3855.2	9697	1939.4	3878.8	9756	1951.2	3902.4	9815	1963	3926	9874	1974.8	3949.6
9639	1927.8	3855.6	9698	1939.6	3879.2	9757	1951.4	3902.8	9816	1963.2	3926.4	9875	1975	3950
9640	1928	3856	9699	1939.8	3879.6	9758	1951.6	3903.2	9817	1963.4	3926.8	9876	1975.2	3950.4
9641	1928.2	3856.4	9700	1940	3880	9759	1951.8	3903.6	9818	1963.6	3927.2	9877	1975.4	3950.8
9642	1928.4	3856.8	9701	1940.2	3880.4	9760	1952	3904	9819	1963.8	3927.6	9878	1975.6	3951.2
9643	1928.6	3857.2	9702	1940.4	3880.8	9761	1952.2	3904.4	9820	1964	3928	9879	1975.8	3951.6
9644	1928.8	3857.6	9703	1940.6	3881.2	9762	1952.4	3904.8	9821	1964.2	3928.4	9880	1976	3952
9645	1929	3858	9704	1940.8	3881.6	9763	1952.6	3905.2	9822	1964.4	3928.8	9881	1976.2	3952.4
9646	1929.2	3858.4	9705	1941	3882	9764	1952.8	3905.6	9823	1964.6	3929.2	9882	1976.4	3952.8
9647	1929.4	3858.8	9706	1941.2	3882.4	9765	1953	3906	9824	1964.8	3929.6	9883	1976.6	3953.2
9648	1929.6	3859.2	9707	1941.4	3882.8	9766	1953.2	3906.4	9825	1965	3930	9884	1976.8	3953.6
9649	1929.8	3859.6	9708	1941.6	3883.2	9767	1953.4	3906.8	9826	1965.2	3930.4	9885	1977	3954
9650	1930	3860	9709	1941.8	3883.6	9768	1953.6	3907.2	9827	1965.4	3930.8	9886	1977.2	3954.4
9651	1930.2	3860.4	9710	1942	3884	9769	1953.8	3907.6	9828	1965.6	3931.2	9887	1977.4	3954.8
9652	1930.4	3860.8	9711	1942.2	3884.4	9770	1954	3908	9829	1965.8	3931.6	9888	1977.6	3955.2
9653	1930.6	3861.2	9712	1942.4	3884.8	9771	1954.2	3908.4	9830	1966	3932			
9654	1930.8	3861.6	9713	1942.6	3885.2	9772	1954.4	3908.8	9831	1966.2	3932.4			
9655	1931	3862	9714	1942.8	3885.6	9773	1954.6	3909.2	9832	1966.4	3932.8			
9656	1931.2	3862.4	9715	1943	3886	9774	1954.8	3909.6	9833	1966.6	3933.2			
9657	1931.4	3862.8	9716	1943.2	3886.4	9775	1955	3910	9834	1966.8	3933.6			
9658	1931.6	3863.2	9717	1943.4	3886.8	9776	1955.2	3910.4	9835	1967	3934			
9659	1931.8	3863.6	9718	1943.6	3887.2	9777	1955.4	3910.8	9836	1967.2	3934.4			
9660	1932	3864	9719	1943.8	3887.6	9778	1955.6	3911.2	9837	1967.4	3934.8			
9661	1932.2	3864.4	9720	1944	3888	9779	1955.8	3911.6	9838	1967.6	3935.2			
9662	1932.4	3864.8	9721	1944.2	3888.4	9780	1956	3912	9839	1967.8	3935.6			
9663	1932.6	3865.2	9722	1944.4	3888.8	9781	1956.2	3912.4	9840	1968	3936			
9664	1932.8	3865.6	9723	1944.6	3889.2	9782	1956.4	3912.8	9841	1968.2	3936.4			
9665	1933	3866	9724	1944.8	3889.6	9783	1956.6	3913.2	9842	1968.4	3936.8			
9666	1933.2	3866.4	9725	1945	3890	9784	1956.8	3913.6	9843	1968.6	3937.2			
9667	1933.4	3866.8	9726	1945.2	3890.4	9785	1957	3914	9844	1968.8	3937.6			
9668	1933.6	3867.2	9727	1945.4	3890.8	9786	1957.2	3914.4	9845	1969	3938			
9669	1933.8	3867.6	9728	1945.6	3891.2	9787	1957.4	3914.8	9846	1969.2	3938.4			
9670	1934	3868	9729	1945.8	3891.6	9788	1957.6	3915.2	9847	1969.4	3938.8			

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WCDMA 1900 Rx frequencies

Ch	Rx	VCO Rx	Ch	Rx	VCO Rx	Ch	Rx	VCO Rx	Ch	Rx	VCO Rx
9662	1932.4	3864.8	9732	1946.4	3892.8	9801	1960.2	3920.4	9870	1974	3948
412	1932.5	3865	9733	1946.6	3893.2	9802	1960.4	3920.8	9871	1974.2	3948.4
9663	1932.6	3865.2	9734	1946.8	3893.6	9803	1960.6	3921.2	9872	1974.4	3948.8
9664	1932.8	3865.6	9735	1947	3894	9804	1960.8	3921.6	9873	1974.6	3949.2
9665	1933	3866	9736	1947.2	3894.4	9805	1961	3922	9874	1974.8	3949.6
9666	1933.2	3866.4	9737	1947.4	3894.8	9806	1961.2	3922.4	9875	1975	3950
9667	1933.4	3866.8	487	1947.5	3895	9807	1961.4	3922.8	9876	1975.2	3950.4
9668	1933.6	3867.2	9738	1947.6	3895.2	9808	1961.6	3923.2	9877	1975.4	3950.8
9669	1933.8	3867.6	9739	1947.8	3895.6	9809	1961.8	3923.6	9878	1975.6	3951.2
9670	1934	3868	9740	1948	3896	9810	1962	3924	9879	1975.8	3951.6
9671	1934.2	3868.4	9741	1948.2	3896.4	9811	1962.2	3924.4	9880	1976	3952
9672	1934.4	3868.8	9742	1948.4	3896.8	9812	1962.4	3924.8	9881	1976.2	3952.4
9673	1934.6	3869.2	9743	1948.6	3897.2	562	1962.5	3925	9882	1976.4	3952.8
9674	1934.8	3869.6	9744	1948.8	3897.6	9813	1962.6	3925.2	9883	1976.6	3953.2
9675	1935	3870	9745	1949	3898	9814	1962.8	3925.6	9884	1976.8	3953.6
9676	1935.2	3870.4	9746	1949.2	3898.4	9815	1963	3926	9885	1977	3954
9677	1935.4	3870.8	9747	1949.4	3898.8	9816	1963.2	3926.4	9886	1977.2	3954.4
9678	1935.6	3871.2	9748	1949.6	3899.2	9817	1963.4	3926.8	9887	1977.4	3954.8
9679	1935.8	3871.6	9749	1949.8	3899.6	9818	1963.6	3927.2	637	1977.5	3955
9680	1936	3872	9750	1950	3900	9819	1963.8	3927.6	9888	1977.6	3955.2
9681	1936.2	3872.4	9751	1950.2	3900.4	9820	1964	3928	9889	1977.8	3955.6
9682	1936.4	3872.8	9752	1950.4	3900.8	9821	1964.2	3928.4	9890	1978	3956
9683	1936.6	3873.2	9753	1950.6	3901.2	9822	1964.4	3928.8	9891	1978.2	3956.4
9684	1936.8	3873.6	9754	1950.8	3901.6	9823	1964.6	3929.2	9892	1978.4	3956.8
9685	1937	3874	9755	1951	3902	9824	1964.8	3929.6	9893	1978.6	3957.2
9686	1937.2	3874.4	9756	1951.2	3902.4	9825	1965	3930	9894	1978.8	3957.6
9687	1937.4	3874.8	9757	1951.4	3902.8	9826	1965.2	3930.4	9895	1979	3958
437	1937.5	3875	9758	1951.6	3903.2	9827	1965.4	3930.8	9896	1979.2	3958.4
9688	1937.6	3875.2	9759	1951.8	3903.6	9828	1965.6	3931.2	9897	1979.4	3958.8
9689	1937.8	3875.6	9760	1952	3904	9829	1965.8	3931.6	9898	1979.6	3959.2
9690	1938	3876	9761	1952.2	3904.4	9830	1966	3932	9899	1979.8	3959.6
9691	1938.2	3876.4	9762	1952.4	3904.8	9831	1966.2	3932.4	9900	1980	3960
9692	1938.4	3876.8	512	1952.5	3905	9832	1966.4	3932.8	9901	1980.2	3960.4
9693	1938.6	3877.2	9763	1952.6	3905.2	9833	1966.6	3933.2	9902	1980.4	3960.8
9694	1938.8	3877.6	9764	1952.8	3905.6	9834	1966.8	3933.6	9903	1980.6	3961.2
9695	1939	3878	9765	1953	3906	9835	1967	3934	9904	1980.8	3961.6
9696	1939.2	3878.4	9766	1953.2	3906.4	9836	1967.2	3934.4	9905	1981	3962
9697	1939.4	3878.8	9767	1953.4	3906.8	9837	1967.4	3934.8	9906	1981.2	3962.4
9698	1939.6	3879.2	9768	1953.6	3907.2	587	1967.5	3935	9907	1981.4	3962.8
9699	1939.8	3879.6	9769	1953.8	3907.6	9838	1967.6	3935.2	9908	1981.6	3963.2
9700	1940	3880	9770	1954	3908	9839	1967.8	3935.6	9909	1981.8	3963.6
9701	1940.2	3880.4	9771	1954.2	3908.4	9840	1968	3936	9910	1982	3964
9702	1940.4	3880.8	9772	1954.4	3908.8	9841	1968.2	3936.4	9911	1982.2	3964.4
9703	1940.6	3881.2	9773	1954.6	3909.2	9842	1968.4	3936.8	9912	1982.4	3964.8
9704	1940.8	3881.6	9774	1954.8	3909.6	9843	1968.6	3937.2	662	1982.5	3965
9705	1941	3882	9775	1955	3910	9844	1968.8	3937.6	9913	1982.6	3965.2
9706	1941.2	3882.4	9776	1955.2	3910.4	9845	1969	3938	9914	1982.8	3965.6
9707	1941.4	3882.8	9777	1955.4	3910.8	9846	1969.2	3938.4	9915	1983	3966
9708	1941.6	3883.2	9778	1955.6	3911.2	9847	1969.4	3938.8	9916	1983.2	3966.4
9709	1941.8	3883.6	9779	1955.8	3911.6	9848	1969.6	3939.2	9917	1983.4	3966.8
9710	1942	3884	9780	1956	3912	9849	1969.8	3939.6	9918	1983.6	3967.2
9711	1942.2	3884.4	9781	1956.2	3912.4	9850	1970	3940	9919	1983.8	3967.6
9712	1942.4	3884.8	9782	1956.4	3912.8	9851	1970.2	3940.4	9920	1984	3968
462	1942.5	3885	9783	1956.6	3913.2	9852	1970.4	3940.8	9921	1984.2	3968.4
9713	1942.6	3885.2	9784	1956.8	3913.6	9853	1970.6	3941.2	9922	1984.4	3968.8
9714	1942.8	3885.6	9785	1957	3914	9854	1970.8	3941.6	9923	1984.6	3969.2
9715	1943	3886	9786	1957.2	3914.4	9855	1971	3942	9924	1984.8	3969.6
9716	1943.2	3886.4	9787	1957.4	3914.8	9856	1971.2	3942.4	9925	1985	3970
9717	1943.4	3886.8	537	1957.5	3915	9857	1971.4	3942.8	9926	1985.2	3970.4
9718	1943.6	3887.2	9788	1957.6	3915.2	9858	1971.6	3943.2	9927	1985.4	3970.8
9719	1943.8	3887.6	9789	1957.8	3915.6	9859	1971.8	3943.6	9928	1985.6	3971.2
9720	1944	3888	9790	1958	3916	9860	1972	3944	9929	1985.8	3971.6
9721	1944.2	3888.4	9791	1958.2	3916.4	9861	1972.2	3944.4	9930	1986	3972
9722	1944.4	3888.8	9792	1958.4	3916.8	9862	1972.4	3944.8	9931	1986.2	3972.4
9723	1944.6	3889.2	9793	1958.6	3917.2	612	1972.5	3945	9932	1986.4	3972.8
9724	1944.8	3889.6	9794	1958.8	3917.6	9863	1972.6	3945.2	9933	1986.6	3973.2
9725	1945	3890	9795	1959	3918	9864	1972.8	3945.6	9934	1986.8	3973.6
9726	1945.2	3890.4	9796	1959.2	3918.4	9865	1973	3946	9935	1987	3974
9727	1945.4	3890.8	9797	1959.4	3918.8	9866	1973.2	3946.4	9936	1987.2	3974.4
9728	1945.6	3891.2	9798	1959.6	3919.2	9867	1973.4	3946.8	9937	1987.4	3974.8
9729	1945.8	3891.6	9799	1959.8	3919.6	9868	1973.6	3947.2	687	1987.5	3975
9730	1946	3892	9800	1960	3920	9869	1973.8	3947.6	9938	1987.6	3975.2
9731	1946.2	3892.4									

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WCDMA 1900 Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
9262	1852.4	3704.8	9332	1866.4	3732.8	9401	1880.2	3760.4	9470	1894	3788
12	1852.5	3705	9333	1866.6	3733.2	9402	1880.4	3760.8	9471	1894.2	3788.4
9263	1852.6	3705.2	9334	1866.8	3733.6	9403	1880.6	3761.2	9472	1894.4	3788.8
9264	1852.8	3705.6	9335	1867	3734	9404	1880.8	3761.6	9473	1894.6	3789.2
9265	1853	3706	9336	1867.2	3734.4	9405	1881	3762	9474	1894.8	3789.6
9266	1853.2	3706.4	9337	1867.4	3734.8	9406	1881.2	3762.4	9475	1895	3790
9267	1853.4	3706.8	87	1867.5	3735	9407	1881.4	3762.8	9476	1895.2	3790.4
9268	1853.6	3707.2	9338	1867.6	3735.2	9408	1881.6	3763.2	9477	1895.4	3790.8
9269	1853.8	3707.6	9339	1867.8	3735.6	9409	1881.8	3763.6	9478	1895.6	3791.2
9270	1854	3708	9340	1868	3736	9410	1882	3764	9479	1895.8	3791.6
9271	1854.2	3708.4	9341	1868.2	3736.4	9411	1882.2	3764.4	9480	1896	3792
9272	1854.4	3708.8	9342	1868.4	3736.8	9412	1882.4	3764.8	9481	1896.2	3792.4
9273	1854.6	3709.2	9343	1868.6	3737.2	162	1882.5	3765	9482	1896.4	3792.8
9274	1854.8	3709.6	9344	1868.8	3737.6	9413	1882.6	3765.2	9483	1896.6	3793.2
9275	1855	3710	9345	1869	3738	9414	1882.8	3765.6	9484	1896.8	3793.6
9276	1855.2	3710.4	9346	1869.2	3738.4	9415	1883	3766	9485	1897	3794
9277	1855.4	3710.8	9347	1869.4	3738.8	9416	1883.2	3766.4	9486	1897.2	3794.4
9278	1855.6	3711.2	9348	1869.6	3739.2	9417	1883.4	3766.8	9487	1897.4	3794.8
9279	1855.8	3711.6	9349	1869.8	3739.6	9418	1883.6	3767.2	237	1897.5	3795
9280	1856	3712	9350	1870	3740	9419	1883.8	3767.6	9488	1897.6	3795.2
9281	1856.2	3712.4	9351	1870.2	3740.4	9420	1884	3768	9489	1897.8	3795.6
9282	1856.4	3712.8	9352	1870.4	3740.8	9421	1884.2	3768.4	9490	1898	3796
9283	1856.6	3713.2	9353	1870.6	3741.2	9422	1884.4	3768.8	9491	1898.2	3796.4
9284	1856.8	3713.6	9354	1870.8	3741.6	9423	1884.6	3769.2	9492	1898.4	3796.8
9285	1857	3714	9355	1871	3742	9424	1884.8	3769.6	9493	1898.6	3797.2
9286	1857.2	3714.4	9356	1871.2	3742.4	9425	1885	3770	9494	1898.8	3797.6
9287	1857.4	3714.8	9357	1871.4	3742.8	9426	1885.2	3770.4	9495	1899	3798
37	1857.5	3715	9358	1871.6	3743.2	9427	1885.4	3770.8	9496	1899.2	3798.4
9288	1857.6	3715.2	9359	1871.8	3743.6	9428	1885.6	3771.2	9497	1899.4	3798.8
9289	1857.8	3715.6	9360	1872	3744	9429	1885.8	3771.6	9498	1899.6	3799.2
9290	1858	3716	9361	1872.2	3744.4	9430	1886	3772	9499	1899.8	3799.6
9291	1858.2	3716.4	9362	1872.4	3744.8	9431	1886.2	3772.4	9500	1900	3800
9292	1858.4	3716.8	112	1872.5	3745	9432	1886.4	3772.8	9501	1900.2	3800.4
9293	1858.6	3717.2	9363	1872.6	3745.2	9433	1886.6	3773.2	9502	1900.4	3800.8
9294	1858.8	3717.6	9364	1872.8	3745.6	9434	1886.8	3773.6	9503	1900.6	3801.2
9295	1859	3718	9365	1873	3746	9435	1887	3774	9504	1900.8	3801.6
9296	1859.2	3718.4	9366	1873.2	3746.4	9436	1887.2	3774.4	9505	1901	3802
9297	1859.4	3718.8	9367	1873.4	3746.8	9437	1887.4	3774.8	9506	1901.2	3802.4
9298	1859.6	3719.2	9368	1873.6	3747.2	187	1887.5	3775	9507	1901.4	3802.8
9299	1859.8	3719.6	9369	1873.8	3747.6	9438	1887.6	3775.2	9508	1901.6	3803.2
9300	1860	3720	9370	1874	3748	9439	1887.8	3775.6	9509	1901.8	3803.6
9301	1860.2	3720.4	9371	1874.2	3748.4	9440	1888	3776	9510	1902	3804
9302	1860.4	3720.8	9372	1874.4	3748.8	9441	1888.2	3776.4	9511	1902.2	3804.4
9303	1860.6	3721.2	9373	1874.6	3749.2	9442	1888.4	3776.8	9512	1902.4	3804.8
9304	1860.8	3721.6	9374	1874.8	3749.6	9443	1888.6	3777.2	262	1902.5	3805
9305	1861	3722	9375	1875	3750	9444	1888.8	3777.6	9513	1902.6	3805.2
9306	1861.2	3722.4	9376	1875.2	3750.4	9445	1889	3778	9514	1902.8	3805.6
9307	1861.4	3722.8	9377	1875.4	3750.8	9446	1889.2	3778.4	9515	1903	3806
9308	1861.6	3723.2	9378	1875.6	3751.2	9447	1889.4	3778.8	9516	1903.2	3806.4
9309	1861.8	3723.6	9379	1875.8	3751.6	9448	1889.6	3779.2	9517	1903.4	3806.8
9310	1862	3724	9380	1876	3752	9449	1889.8	3779.6	9518	1903.6	3807.2
9311	1862.2	3724.4	9381	1876.2	3752.4	9450	1890	3780	9519	1903.8	3807.6
9312	1862.4	3724.8	9382	1876.4	3752.8	9451	1890.2	3780.4	9520	1904	3808
62	1862.5	3725	9383	1876.6	3753.2	9452	1890.4	3780.8	9521	1904.2	3808.4
9313	1862.6	3725.2	9384	1876.8	3753.6	9453	1890.6	3781.2	9522	1904.4	3808.8
9314	1862.8	3725.6	9385	1877	3754	9454	1890.8	3781.6	9523	1904.6	3809.2
9315	1863	3726	9386	1877.2	3754.4	9455	1891	3782	9524	1904.8	3809.6
9316	1863.2	3726.4	9387	1877.4	3754.8	9456	1891.2	3782.4	9525	1905	3810
9317	1863.4	3726.8	137	1877.5	3755	9457	1891.4	3782.8	9526	1905.2	3810.4
9318	1863.6	3727.2	9388	1877.6	3755.2	9458	1891.6	3783.2	9527	1905.4	3810.8
9319	1863.8	3727.6	9389	1877.8	3755.6	9459	1891.8	3783.6	9528	1905.6	3811.2
9320	1864	3728	9390	1878	3756	9460	1892	3784	9529	1905.8	3811.6
9321	1864.2	3728.4	9391	1878.2	3756.4	9461	1892.2	3784.4	9530	1906	3812
9322	1864.4	3728.8	9392	1878.4	3756.8	9462	1892.4	3784.8	9531	1906.2	3812.4
9323	1864.6	3729.2	9393	1878.6	3757.2	212	1892.5	3785	9532	1906.4	3812.8
9324	1864.8	3729.6	9394	1878.8	3757.6	9463	1892.6	3785.2	9533	1906.6	3813.2
9325	1865	3730	9395	1879	3758	9464	1892.8	3785.6	9534	1906.8	3813.6
9326	1865.2	3730.4	9396	1879.2	3758.4	9465	1893	3786	9535	1907	3814
9327	1865.4	3730.8	9397	1879.4	3758.8	9466	1893.2	3786.4	9536	1907.2	3814.4
9328	1865.6	3731.2	9398	1879.6	3759.2	9467	1893.4	3786.8	9537	1907.4	3814.8
9329	1865.8	3731.6	9399	1879.8	3759.6	9468	1893.6	3787.2	287	1907.5	3815
9330	1866	3732	9400	1880	3760	9469	1893.8	3787.6	9538	1907.6	3815.2
9331	1866.2	3732.4									

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10 — Schematics

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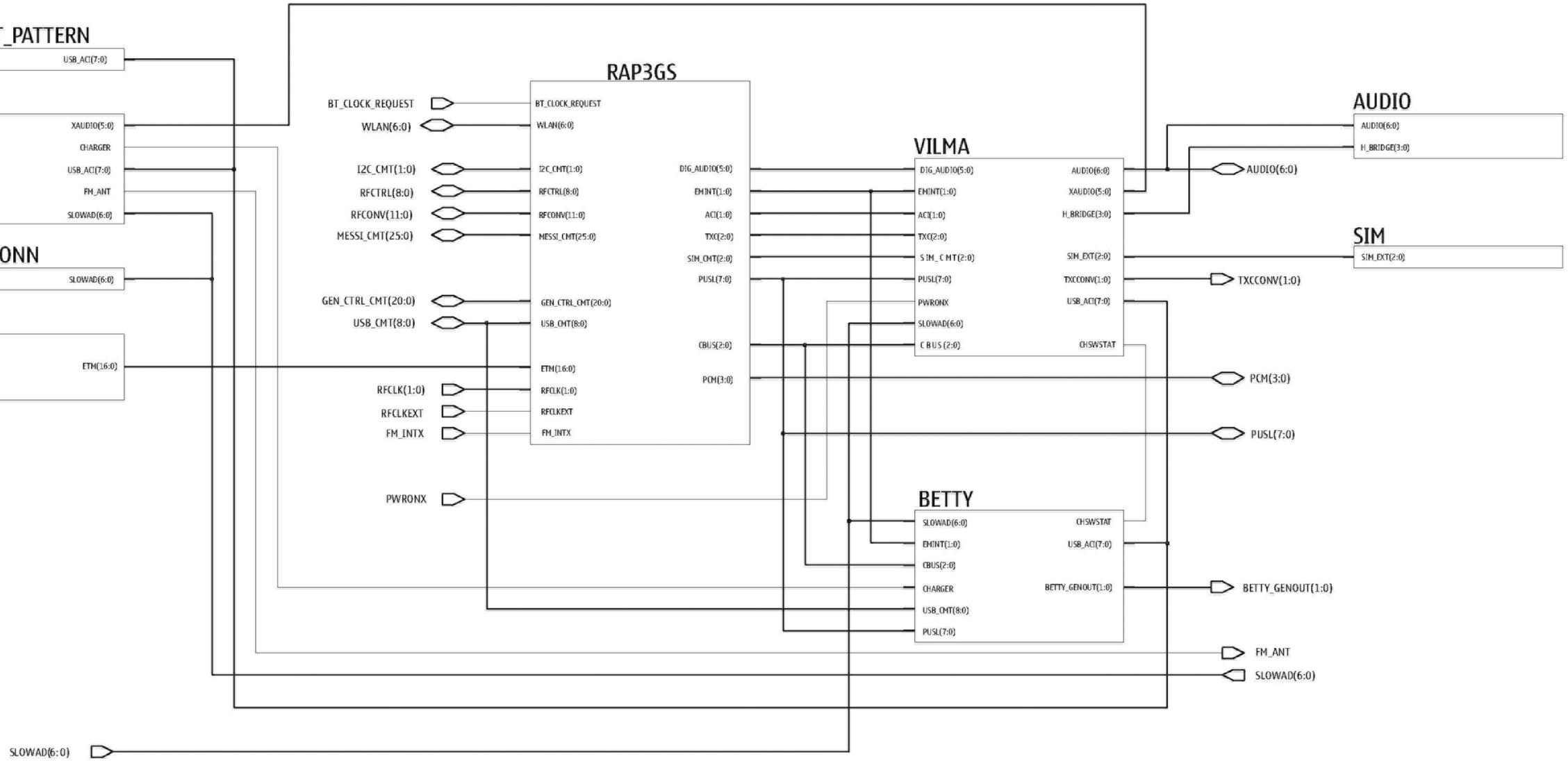
Baseband connections



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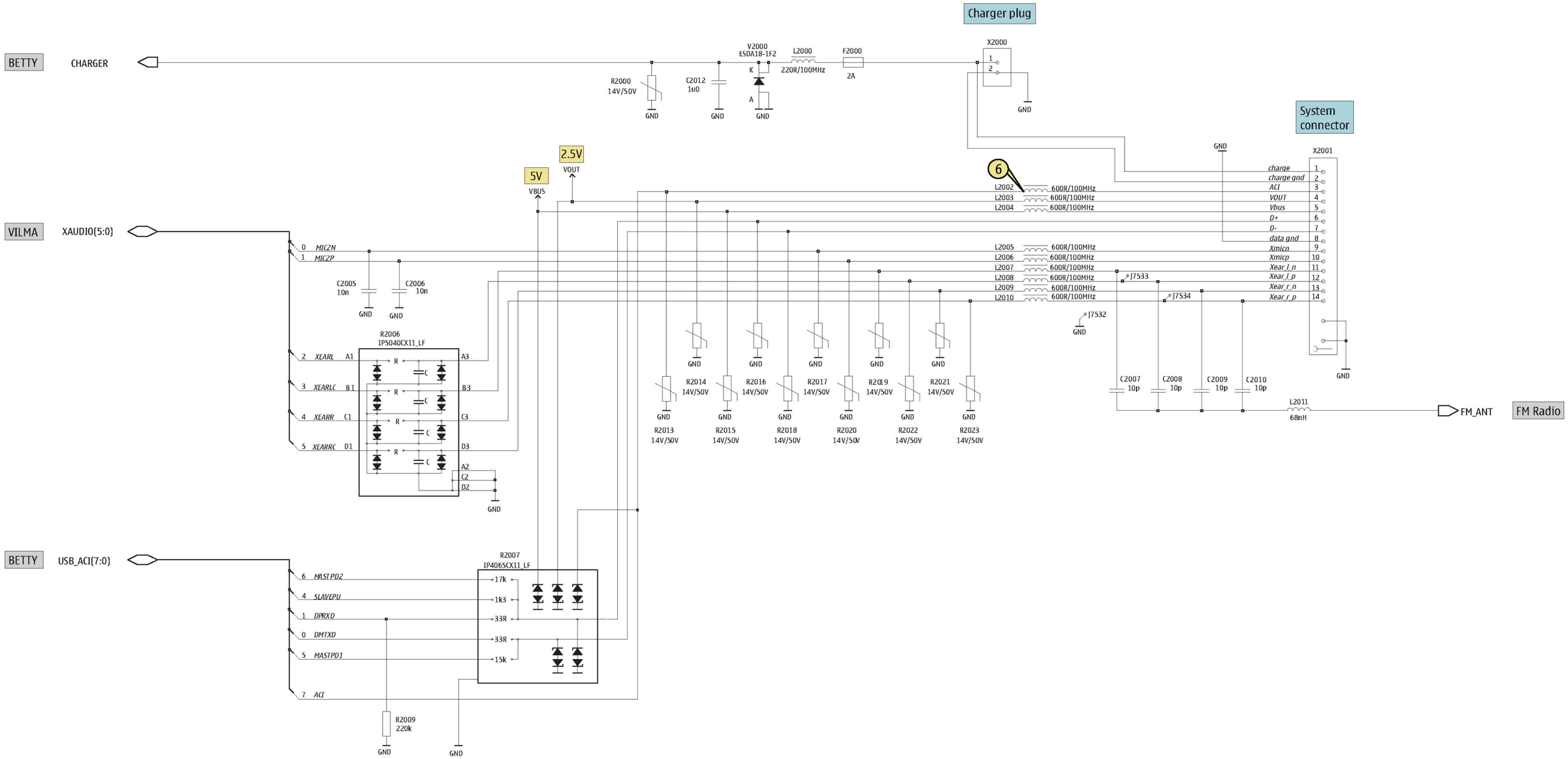
System connector



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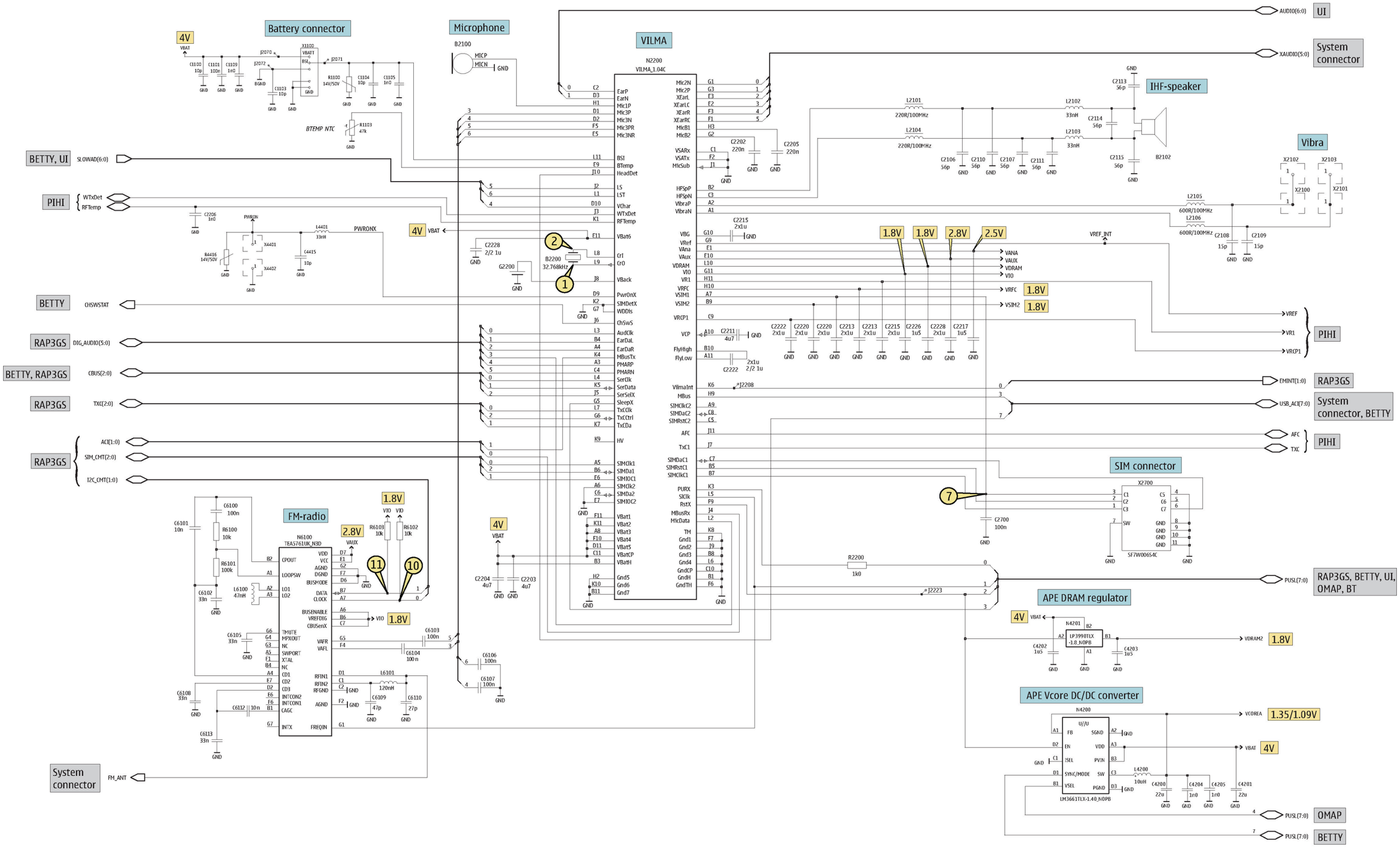
VILMA, SIM, audio



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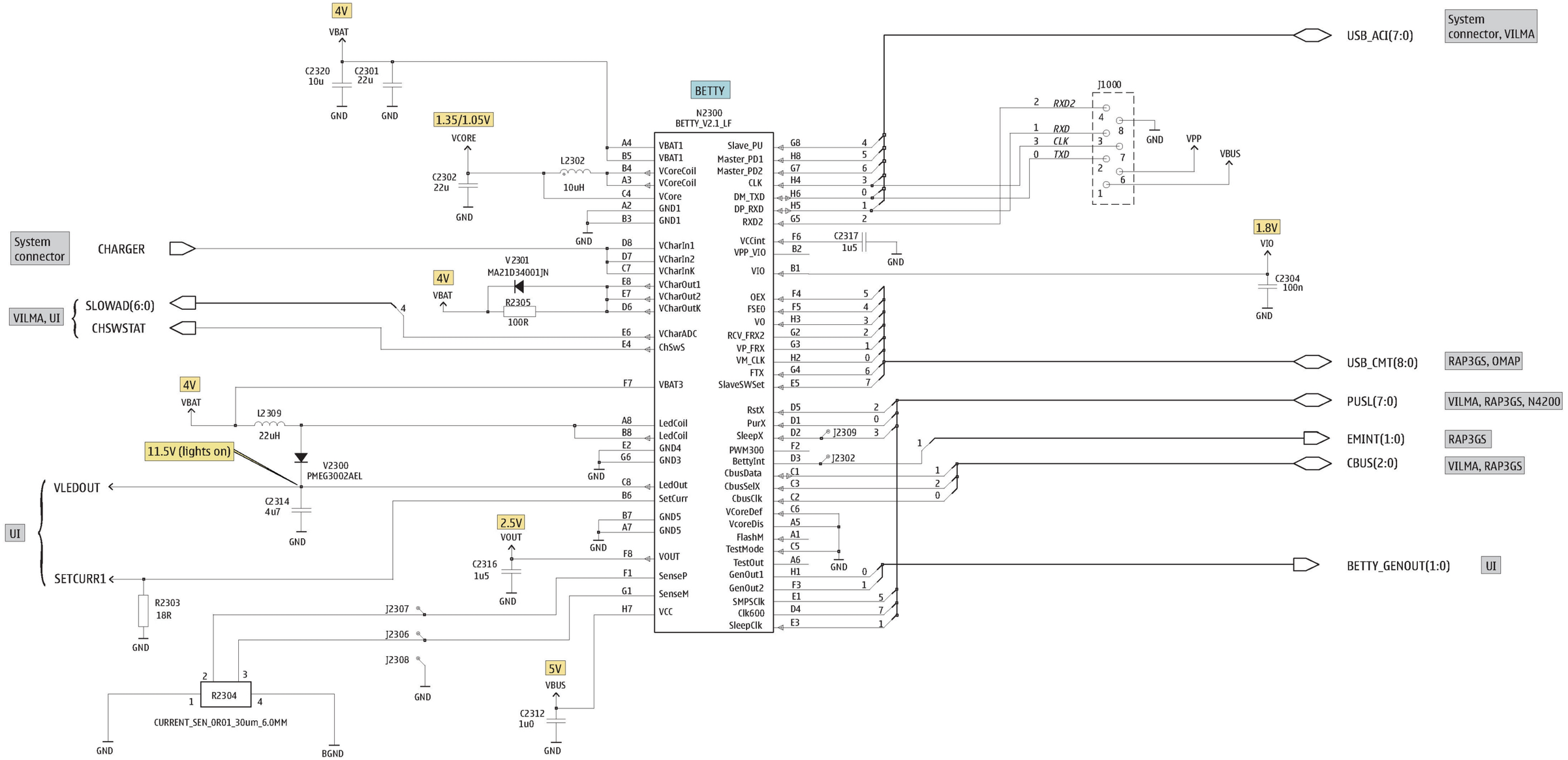
BETTY



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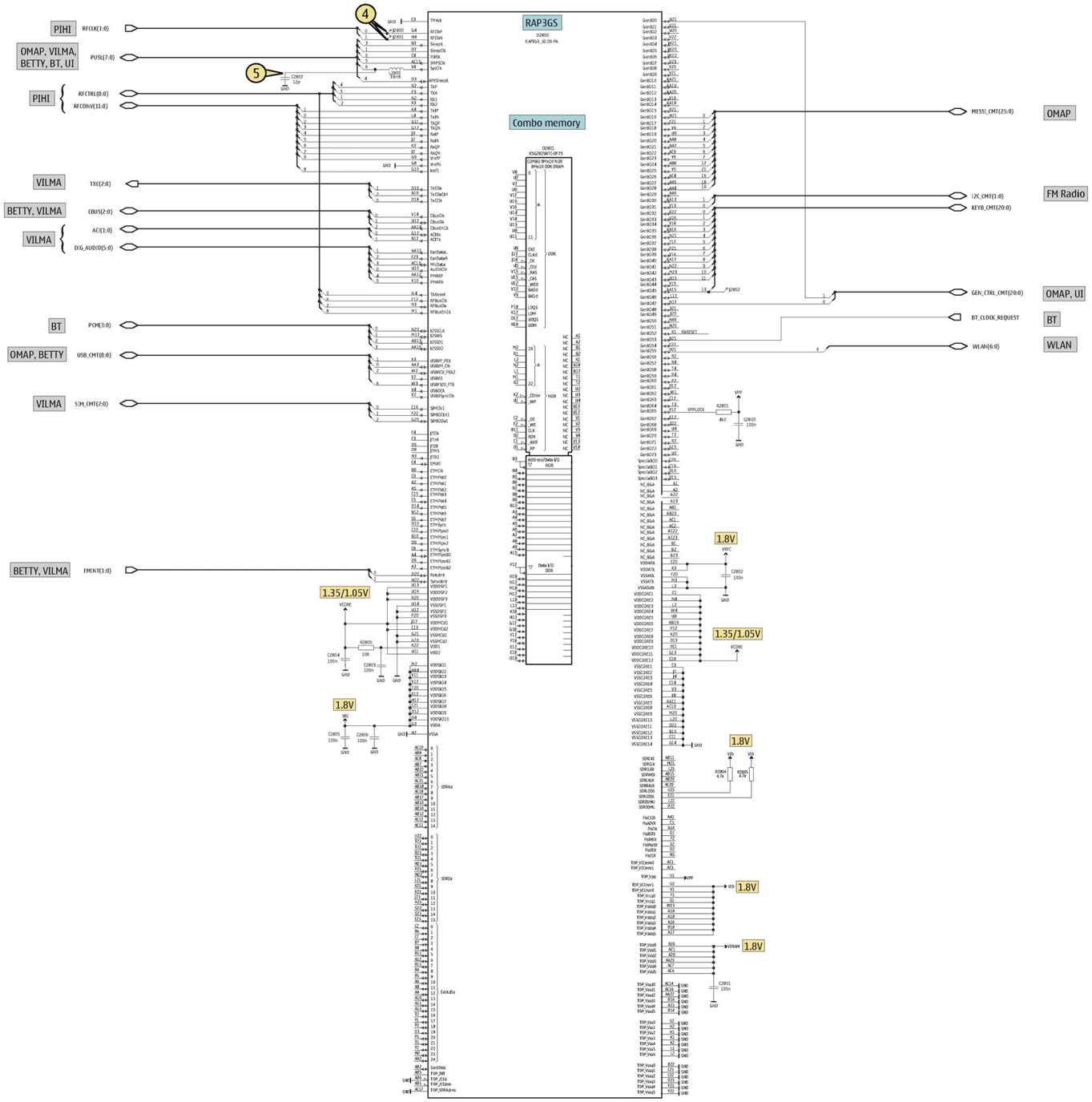
RAP3GS



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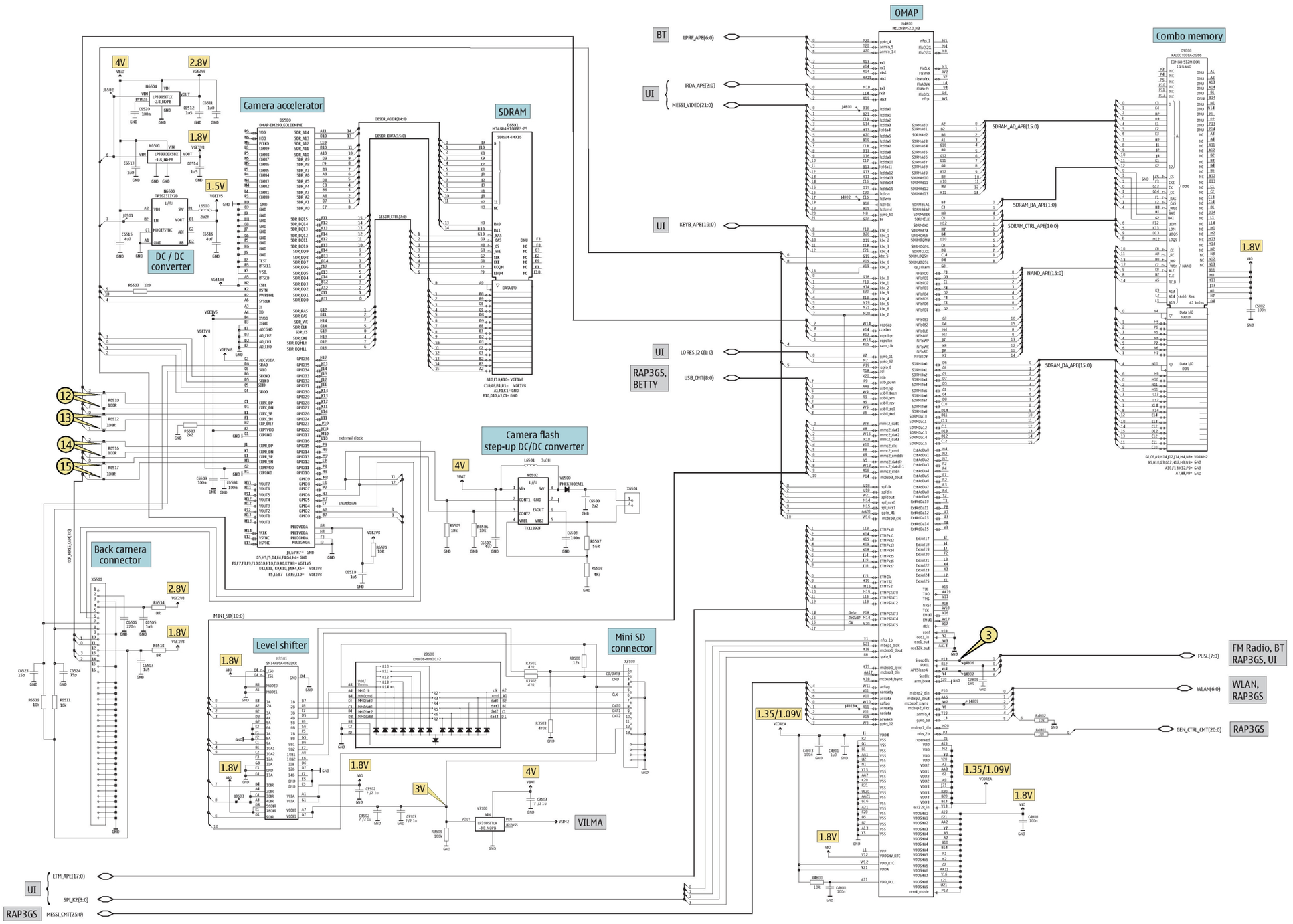
OMAP, combo memory, mini SD, SDRAM, back camera



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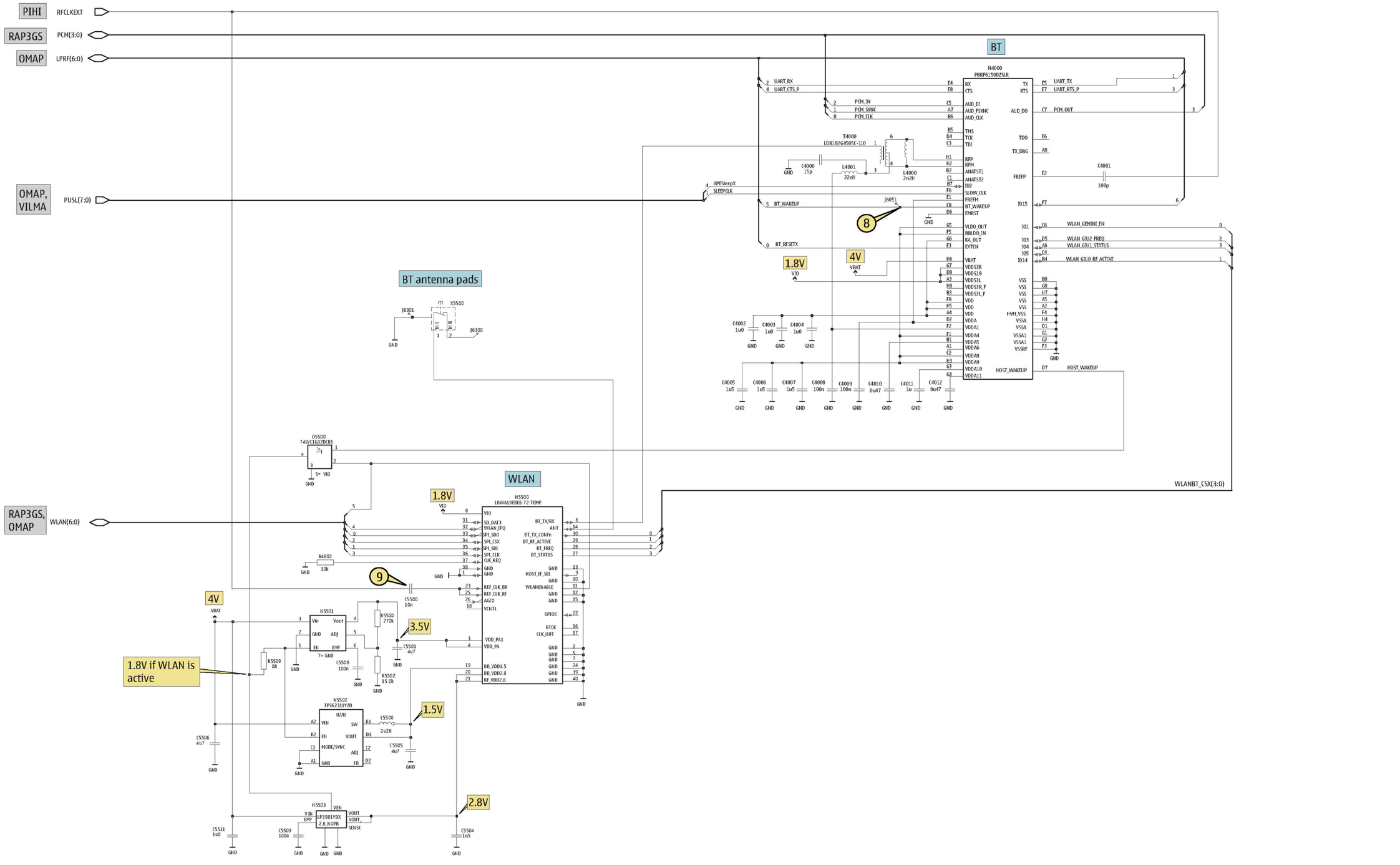
Bluetooth, WLAN



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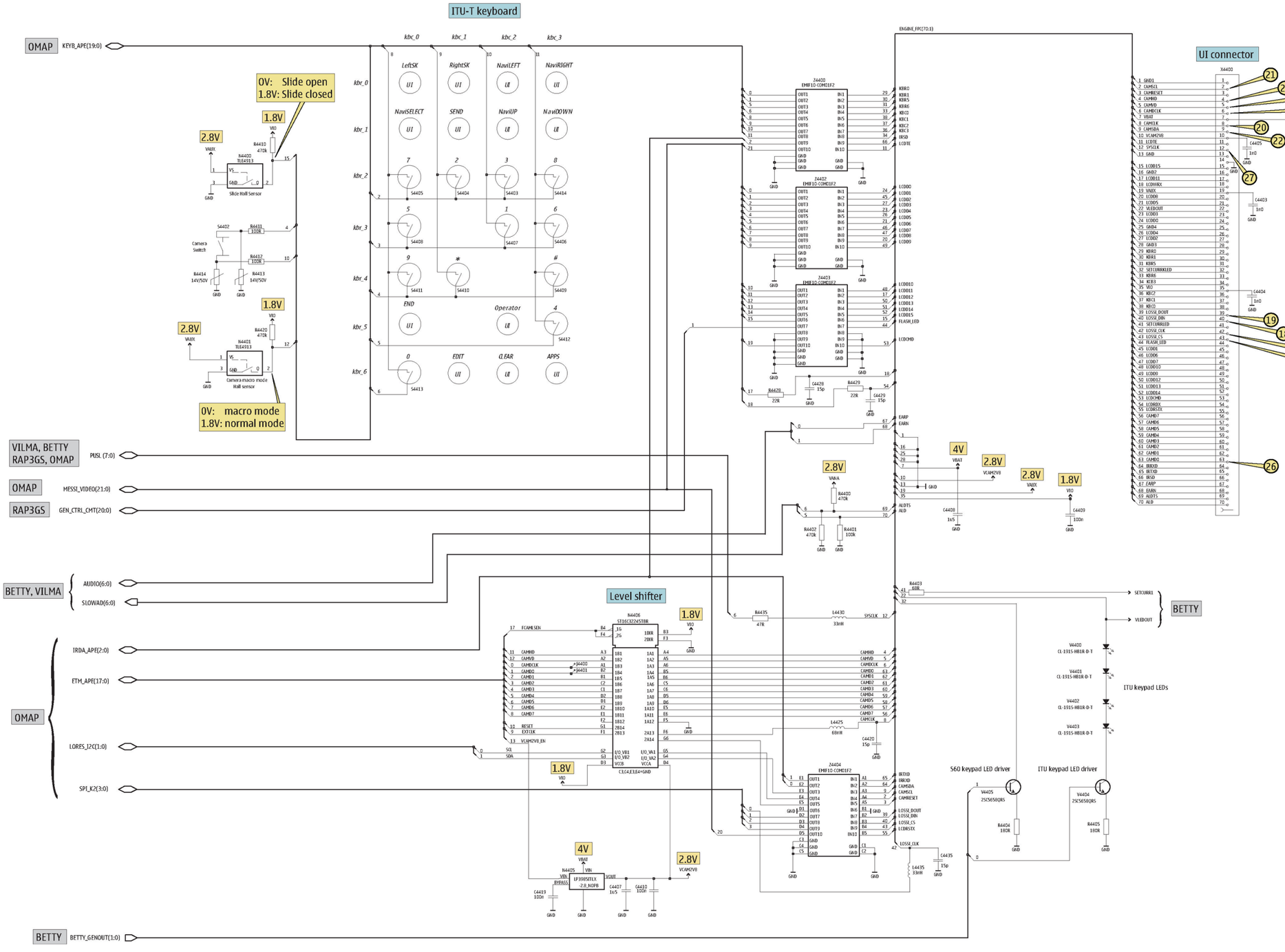
UI



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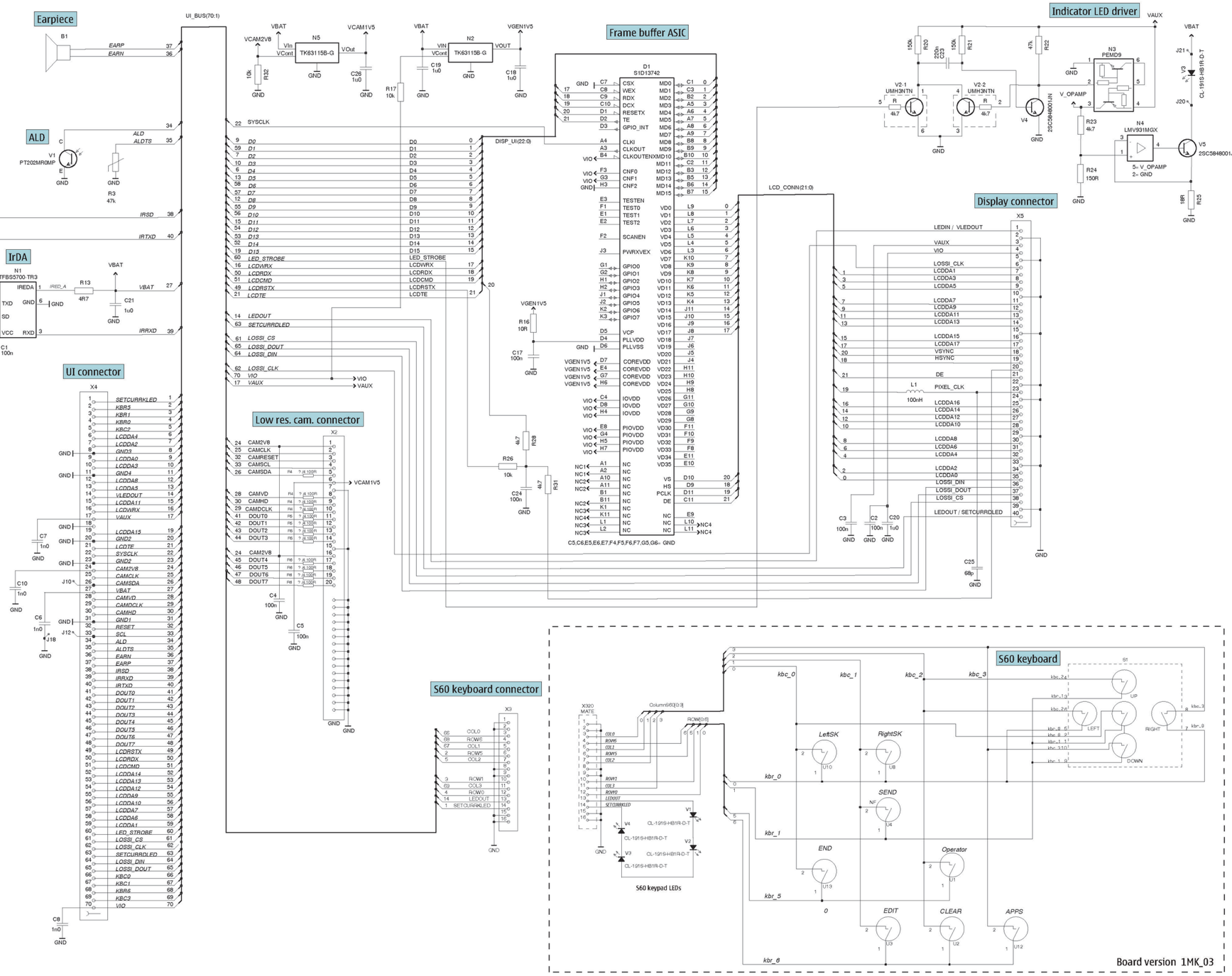
UI module



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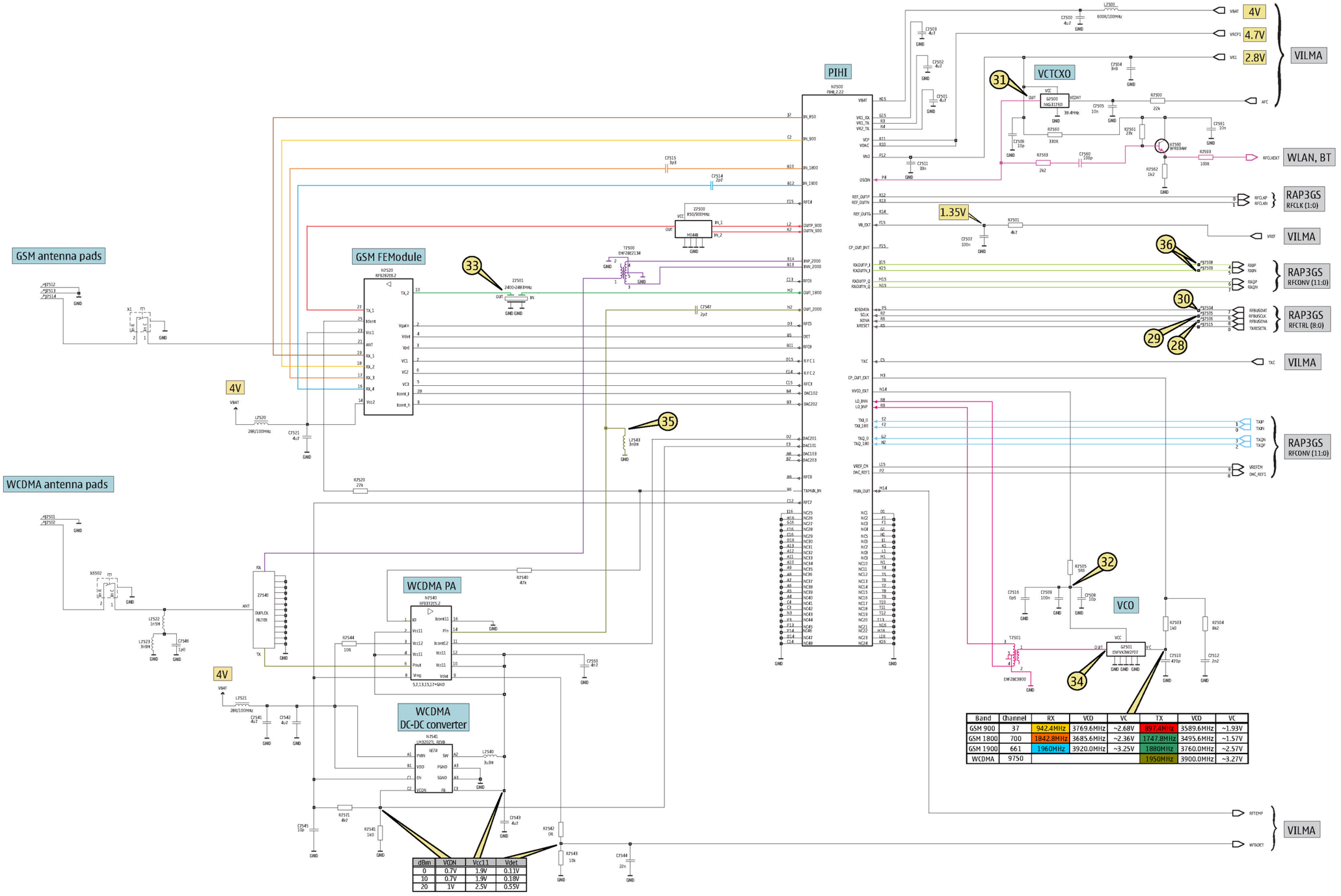
RF part



dBm	VCON	Vcc11	Vdet
0	0.7V	1.9V	0.11V
10	0.7V	1.9V	0.18V
20	1V	2.5V	0.55V

Band	Channel	RX	VCO	VC	TX	VCO	VC
GSM 900	37	942.4MHz	3769.6MHz	~2.68V	897.4MHz	3589.6MHz	~1.93V
GSM 1800	700	1842.8MHz	3685.6MHz	~2.36V	1747.8MHz	3495.6MHz	~1.57V
GSM 1900	661	1960MHz	3920.0MHz	~3.25V	1880MHz	3760.0MHz	~2.57V
WCDMA	9750				1950MHz	3900.0MHz	~3.27V

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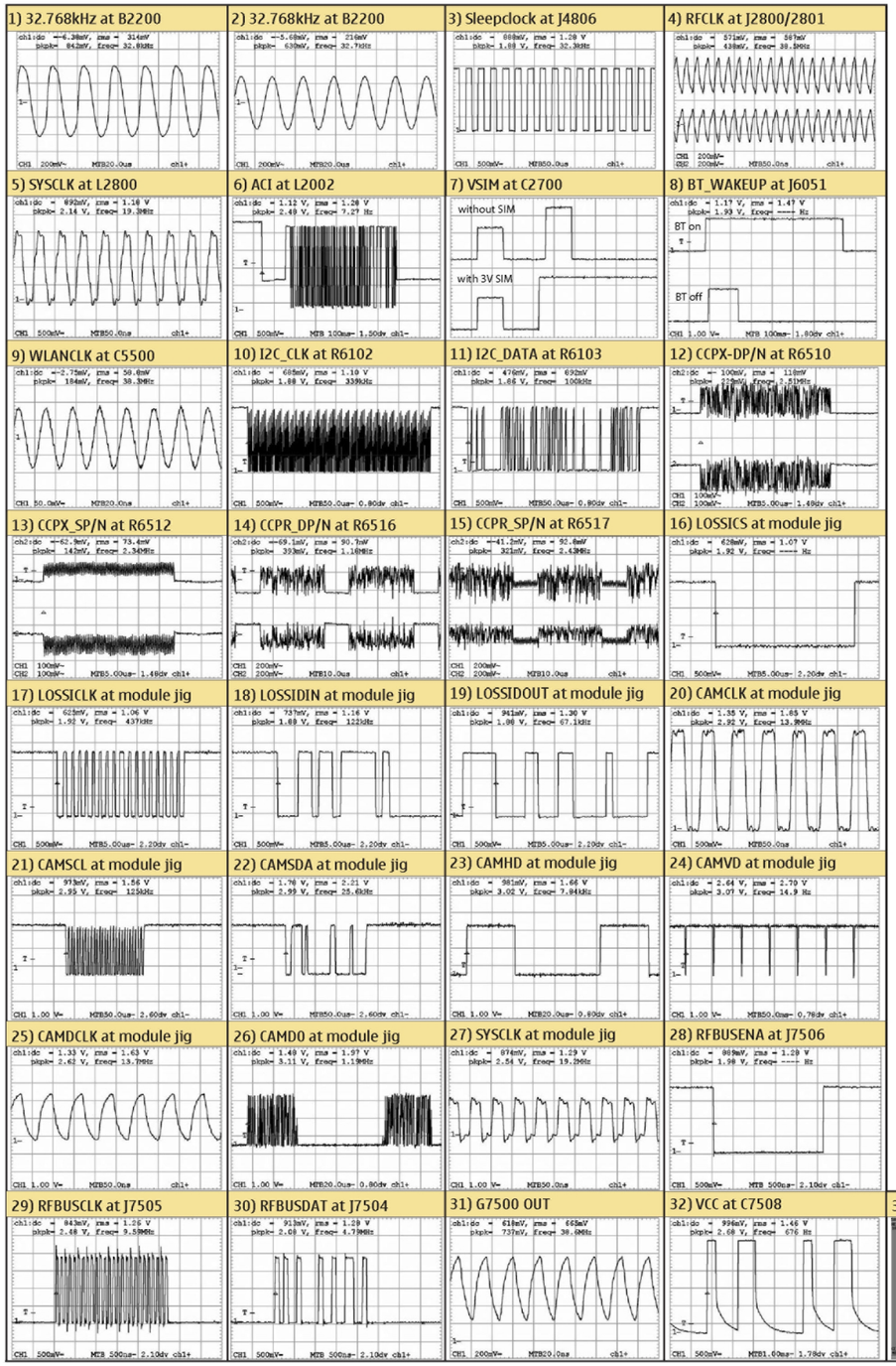
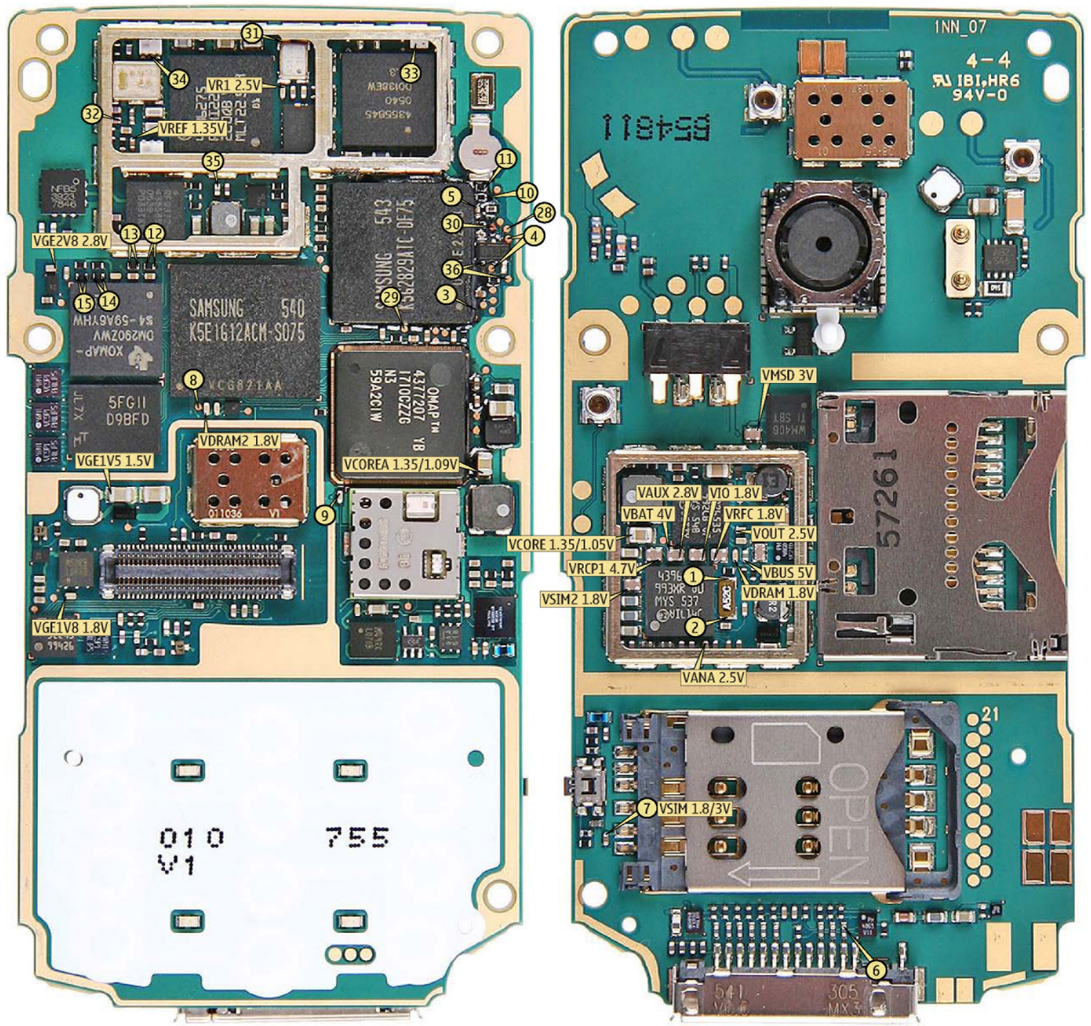
Signal overview





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Component finder

B		C4004	D10	C6511	B13	L2102	I14	R2015	E2	R7500	F16
B2200	G8	C4005	E9	C6512	A13	L2103	I14	R2016	E2	R7501	B16
C		C4006	D10	C6513	A9	L2104	H8	R2017	F2	R7503	B17
C1100	H14	C4007	D9	C6514	B8	L2105	H7	R2018	F2	R7504	D17
C1101	H13	C4008	E9	C6515	C9	L2106	H7	R2019	F2	R7505	B16
C1103	G13	C4009	D9	C6516	B9	L2302	H9	R2020	F2	R7520	G15
C1104	G13	C4010	D9	C6520	A13	L2309	F10	R2021	G2	R7540	D15
C1105	G11	C4011	E10	C6523	D16	L2800	I14	R2022	G2	R7541	E15
C1109	H11	C4012	E10	C6524	E16	L4000	E9	R2023	G2	R7542	B14
C2005	F2	C4200	I10	C7500	C16	L4001	E10	R2200	H10	R7543	E15
C2006	F2	C4201	I11	C7501	D17	L4200	I9	R2303	G10	R7544	D14
C2007	H2	C4202	D11	C7502	E17	L4401	D17	R2305	G9	R7560	E16
C2008	H2	C4203	D11	C7503	C16	L4425	C7	R2800	F14	R7561	E16
C2009	G2	C4204	H10	C7504	E16	L4430	C7	R2801	I14	R7562	D16
C2010	G2	C4205	G12	C7505	F16	L4435	C7	R2804	F14	R7563	E16
C2012	C2	C4402	E7	C7506	E16	L5500	F8	R2805	F14	R7571	E15
C2106	I7	C4403	D8	C7507	C16	L6100	I7	R3500	F8	R7593	D16
C2107	H7	C4404	B7	C7508	B16	L6101	I6	R3501	F8	**S**	
C2108	G7	C4405	D7	C7509	C16	L6500	B9	R3502	F8	S4402	I4
C2109	H7	C4407	A8	C7510	C17	L6501	C15	R3503	F8	**T**	
C2110	I14	C4408	E7	C7511	E16	L7500	C16	R3509	G8	T4000	E9
C2111	I13	C4409	A8	C7512	D17	L7520	G15	R4400	C7	T7500	C15
C2113	I14	C4410	A8	C7514	F17	L7521	E14	R4401	E9	T7501	C17
C2114	I14	C4418	D9	C7515	F17	L7522	A14	R4402	C7	**V**	
C2115	H14	C4419	B9	C7516	B16	L7523	A14	R4403	C9	V2000	B2
C2202	G7	C4420	C7	C7521	F15	L7540	D14	R4404	A9	V2300	G10
C2203	H8	C4428	D9	C7541	E14	L7543	D15	R4405	D7	V2301	F9
C2204	H7	C4429	D9	C7542	E14	**N**		R4410	I13	V4400	F5
C2205	G7	C4435	B7	C7543	D14	N2200	H8	R4411	I5	V4401	F2
C2206	F7	C4800	H12	C7544	E14	N2300	G9	R4412	I3	V4402	D2
C2211	H8	C4801	I11	C7545	B14	N3500	F9	R4413	I5	V4403	D5
C2213	G8	C4803	I11	C7546	B14	N3501	F11	R4414	I4	V4404	C7
C2215	G8	C4808	I11	C7547	D15	N4000	E10	R4416	D17	V4405	A9
C2217	G7	C5002	H12	C7550	B14	N4200	I11	R4420	E12	V6500	B15
C2220	H8	C5500	F9	C7560	E16	N4201	D11	R4428	D9	V7560	D16
C2222	H8	C5501	G7	C7561	E16	N4400	I14	R4429	C9	**X**	
C2226	G8	C5504	G7	**D**		N4401	E12	R4435	C7	X1	F16
C2228	H8	C5505	F7	D2800	G14	N4405	A8	R4800	G12	X1000	I16
C2301	F9	C5506	F7	D2801	G14	N4406	A7	R4801	F11	X1100	G12
C2302	H9	C5508	H7	D5000	E12	N4800	G11	R4802	H12	X2001	F1
C2304	H10	C5509	H7	D5500	H7	N5500	G9	R5500	H7	X2100	A4
C2312	F8	C5511	H7	D6500	B12	N5501	H7	R5502	H7	X2101	A4
C2314	G10	C6100	I8	D6501	B11	N5502	F7	R5509	G7	X2102	A3
C2316	G9	C6101	I8	**F**		N5503	G7	R6100	I8	X2103	A3
C2317	G9	C6102	I8	F2000	D2	N6100	I7	R6101	I8	X2700	F4
C2320	H10	C6103	I8	**G**		N6500	C9	R6102	I15	X3500	C9
C2700	I3	C6104	H7	G2200	I15	N6501	B8	R6103	I15	X4400	D8
C2800	I14	C6105	I7	G7500	E17	N6502	B14	R6503	D16	X4401	E17
C2801	F15	C6106	G7	G7501	C17	N6504	A13	R6505	C13	X4402	E17
C2802	F12	C6107	G7	**L**		N7500	D16	R6506	B13	X5500	I11
C2803	F14	C6108	I7	L2000	C2	N7520	G16	R6507	B13	X6500	E14
C2804	I13	C6109	I5	L2002	E2	N7540	C14	R6508	B14	X6501	C14
C2805	F14	C6110	I5	L2003	E2	N7541	E15	R6509	E16	X6502	B15
C2806	F15	C6112	I8	L2004	E2	**R**		R6510	C13	**Z**	
C2807	I14	C6113	I8	L2005	F2	R1100	G13	R6511	E16	Z3500	F8
C2809	H12	C6500	B14	L2006	F2	R1103	I4	R6512	C13	Z4400	A10
C3502	F10	C6502	B14	L2007	F2	R2000	B2	R6513	B13	Z4402	A11
C3503	F8	C6503	B14	L2008	G2	R2006	G2	R6514	D16	Z4403	A11
C4000	E10	C6506	E16	L2009	G2	R2007	D2	R6516	B13	Z4404	B7
C4001	E10	C6508	C13	L2010	G2	R2009	D2	R6517	B13	Z7500	F16
C4002	E10	C6509	C13	L2011	H2	R2013	E2	R6518	D16	Z7501	H17
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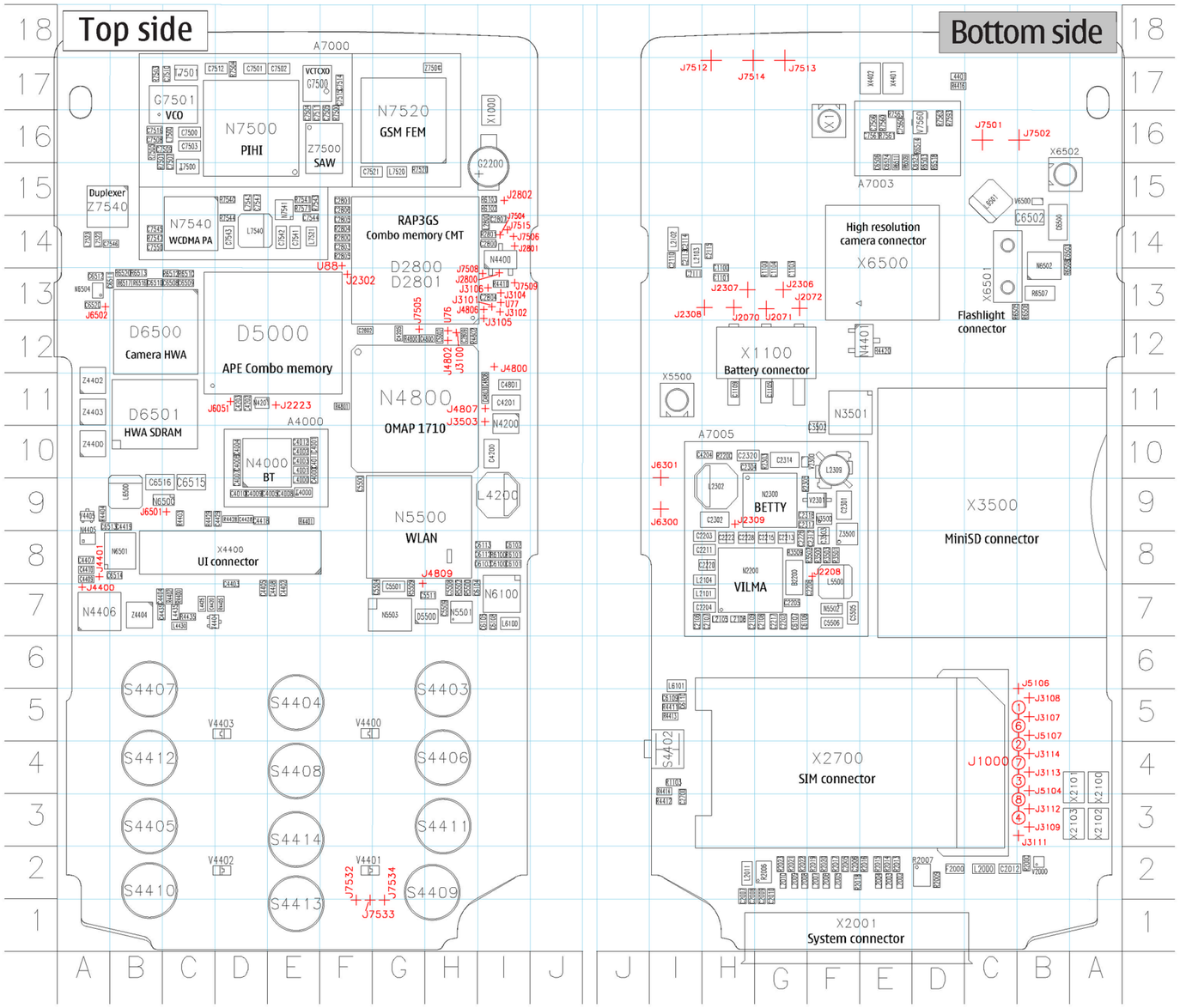

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